THE MINERAL INDUSTRY OF CANADA

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In 2003, Canada's mineral industry produced more than 60 minerals. The country ranked third in terms of value ($1.2 billion) of rough diamond (Natural Resources Canada, 2004b). It ranked first in the production of potash followed by, in order of production, Russia, Belarus, and Germany; second in the production of selenium following Japan; third in the production of nickel following, in order of production, Russia and Australia; and fourth in the production of bismuth following, in order of production, China, Mexico, and Peru and of zinc following, in order of production, China, Australia, and Peru (Jorgenson, 2004a, b; Kuck, 2004; Plachy, 2004; Searls, 2004).

In 2003, Canada had a population of about 32.2 million and a gross domestic product (GDP) of $977 billion[1] in terms of purchasing power parity. Canada's GDP growth was moderate—about 1.7% compared with 3.3% in 2002. The economic slowdown in 2001 and subsequent recovery in 2002-03 were largely affected by the economic sluggishness in the United States in 2001-02. Canada's currency devaluation helped moderate the upturn in economic growth of the second half of 2002 into 2003 (Department of Finance Canada, 2003§[2]; U.S. Central Intelligence Agency, 2003§; International Monetary Fund, 2004§; Statistics Canada, 2004a§). In 2003, inflation was 2.2%, and unemployment increased slightly to 7.7% from 7.6% in 2002 and 6.8% in 2001. Overall, Canada's minerals, metals, and energy sectors contributed 5% of its GDP. The mineral industry played an integral part in Canada's innovative technology-driven and knowledge-based economy (Mercer, 2004; Statistics Canada, 2004e§).

Canadian production of metals, industrial minerals, and coal totaled $14.4 billion, which was 1.4% higher than that of 2002 ($14.2 billion). Of this total, the Canadian nonfuels production was valued at $13.4 billion, which was 2.3% higher than that of 2002 ($13.1 billion); the values of coal and metal outputs decreased by 6.6% and 6.5%, respectively, compared with those of 2002; and the value of industrial minerals (nonmetals) increased by 7.6% compared with that of 2002 (Natural Resources Canada, 2004a, b).

Although some metal prices in world markets rebounded during 2003, metal production was, however, slower to react, and decreased output of base and precious metals affected, in general, the value of mineral output, which decreased by 6.5% in Canada.[3] The value of production for diamond, iron ore, nickel, and nonmetals increased by 7.6%. Iron ore output increased by 6.7%, which was a 13.1% increase in value; nickel output decreased by 13.8%, and its value increased to $1.4 billion in 2003 from $1.2 billion in 2002; zinc (19.5%), copper (8.5%), and gold (7.5%) production declined; and price declines for cobalt, copper, lead, platinum-group metals (PGM), and zinc contributed to the decline in value of Canadian metals—to $6.9 billion in 2003 from $7.4 billion in 2002. Several mineral commodities increased in value—diamond, 117.5%; iron ore, 13.1%; nickel, 4.2%; cement, 4.1%; and potash (K_2O content), 1.3%; these partially offset the decrease of the metals value (Natural Resources Canada, 2004a, b).

In 2003, the leading mineral commodities produced in Canada were gold, $1.6 billion; nickel, $1.4 billion; diamond, $1.2 billion; cement, coal, and potash, $1.1 billion each; iron ore, $1.0 billion; copper, $929 million; sand and gravel and stone, $714 million each; and zinc, $643 million (Natural Resources Canada, 2004b).

The exploration and deposit appraisal spending for Canada has rebounded and gained momentum since 2001 from $366.4 million to $409.3 million in 2002 and $488.6 million in 2003. The exploration process allocated $371.3 million, or 76% of the total, for mineral exploration, and the remaining $117.3 million, or 24%, for deposit appraisals in 2003. Factors that contributed to this recovery trend were better metal prices, successful diamond discoveries, timely tax incentives, and better access to the capital markets. Between January and November 2003, Canadian companies raised $3.6 billion in equity financing for mineral exploration; about 50% of that equity was raised around the world. Also, recognizing the benefits of the temporary Federal and Provincial tax credits introduced in recent years to boost the flow-through shares (FTS) financing process to stimulate exploration, the Federal Government announced in March 2004 an extension of the 15% Federal tax credit for mineral exploration to the end of 2005 (Natural Resources Canada, 2003b, 2004§).

Although exploration and deposit appraisal expenditures in Canada were not fairly characteristic of all the Provinces, expenditures were particularly apparent in Ontario (31.1%), Quebec (18.1%), the Nunavut Territory (12.0%), British Columbia (10.5%), the Northwest Territories (8.2%), and Saskatchewan (7.7%), which together accounted for 87.6% of exploration and deposit appraisal expenditures for the entire country. Increases were equally apparent in Manitoba (4.4%), Newfoundland and Labrador (3.4%), and the Yukon Territory (2.7%) (Natural Resources Canada, 2003c, p. 5). Canada's larger mining companies remained internationally active by continuing to spend 62% of their exploration budgets in other regions, particularly in, in order of expenditures, Asia and the Pacific, Latin America and the Caribbean, and Eastern Europe. Although a large number of Canadian mining companies have been exploring in other countries, such discoveries as, in order of value, Voisey's Bay cooper-nickel project, the Kelex Nickel Zone, the Sudbury Basin's PGM-rich deposits, and the Diavik, the Jericho, and the Snap Lake diamond projects indicated that metals and minerals are still to be found in Canada (Natural Resources Canada, 2003c, p. 24, 127-141).

[1]Where necessary, values have been converted from Canadian dollars (CAN$) to U.S. dollars (US$) at an average rate of CAN$1.40=US$1.00 for 2003. All values in this report, unless otherwise specified, are expressed in U.S. dollars.

[2]References that include a section mark (§) are found in the Internet References Cited section.

[3]More-detailed information on the mineral production in Canada can be found in the Canadian Minerals Yearbooks for 2002 and 2003 prepared by Natural Resources Canada, and the Information Bulletin for 2002 and 2003 compiled by Statistics Canada and issued by Natural Resources Canada, Ottawa, Canada, which were used extensively as source material for this report. The U.S. Department of the Interior has arranged for these Canadian publications to be placed in selected depository libraries of the 50 States and Puerto Rico.

According to predictions for the forthcoming year, spending for precious- and base-metals exploration would be flat, and that for diamond exploration would increase by as much as 25%. In 2003, the Canadian diamond sector was a factor in world diamond markets. In 2004 and beyond, diamond was expected to be the most sought after mineral commodity in the country. Macroeconomics and the globalization of diamond demand have introduced unprecedented levels of volatility into the diamond supply and rough and polished diamond pricing; this takes into consideration increased levels of diamond mining activity and the move to a more-competitive open market for rough diamonds in particular (Natural Resources Canada, 2004b).

Voisey's Bay Nickel Company Limited (a subsidiary of Inco Limited and based in St. John's, Newfoundland) was established to develop the rich (in order of value) nickel, copper, and cobalt deposit on the Labrador Peninsula in eastern Canada. Inco formalized an agreement with the Government of Newfoundland and Labrador to develop the $1.9 billion Voisey's Bay project in mid-2002. In 2003, Inco achieved all major project milestones—completed the bankable feasibility study for phase one; started the Voisey's Bay open pit, concentrator, and related facilities construction at a cost of $470 million; and began testing hydrometallurgical processes to treat Voisey's Bay ores at a pilot plant in Mississauga, Ontario, which produced the first cathode in this facility in June 2003 (Inco Limited, 2003§).

With the strong recovery of nickel prices during 2002 and 2003, additional supplies of nickel were expected from Voisey's Bay, development of other new nickel mines, and producers' destocking (Natural Resources Canada, 2003a, p. 307; 2004b).

According to the Natural Resources Canada's survey of 2003, exploration and deposit appraisal disbursements started in 2001 ($321 million) and continued with increases of 11.8% in 2002 ($359 million) and 36.2% in 2003 ($489 million). This trend appears to have been the result of higher mineral commodity prices in the open markets, the sustained and successful diamond exploration, and access to financing. The share of spending by junior firms remained quite important in the total exploration-phase expenditures (grass-roots exploration)—$111 million in 2001, $131 million in 2002, and $200 million in 2003 (Natural Resources Canada, 2004§).

Environmental compliance continued to be an important issue in mineral exploration and development activities throughout Canada. Mineral exploration was increasingly affected by legal and sociological issues in much of Canada. Land use, which had never been given much attention in the past, has become an issue. First Nation rights were receiving long-awaited consideration. Canada's Minister of Natural Resources stated that Federal and Provincial Governments were working on legislative reforms.

Canadian mining firms were acquiring mineral properties in Latin America where Governments offered incentives to attract foreign investment, 100% ownership was allowed, and profits could be repatriated. A large Canadian exploration company (Canadian senior firm) had a minimum allotment of $3 million for exploration purposes. In 2002 (the latest year for which data were available), planned exploration expenditures in Canada and elsewhere around the world Canadian senior firms amounted to about $670 million; this was down by almost 12% from about $760 million budgeted in 2001. About two-thirds of the decrease in these Canadian exploration expenditures from 2001 to 2002 was expected to take place abroad (Natural Resources Canada, 2003c, p. 128-129).

Government Policies and Programs

The Canadian Provinces exercise primary jurisdiction over mineral resources in the country. Through their mining acts, their governments regulate most aspects of exploration and mining. Exceptions are the Northwest Territories, the Nunavut Territory, and the Yukon Territory, which, although still under the resource-management control of the Canadian Federal Government, were slowly accumulating independent powers. For instance, the Federal, the Territorial, and the First Nation negotiators initiated the Devolution Transfer Agreement (DTA) in September 2001; the DTA transferred the Federal Government's current responsibilities for managing most of the Yukon Territory's natural (mineral-energy) resources to the Territorial; the agreement became effective on April 1, 2003.

On August 20, 2002, Quebec announced a very attractive refundable FTS tax credit for mineral resources. Senior and junior companies will be allowed a tax credit of up to 60% of exploration expenditures until 2007. In 2003, the Yukon Territory offered an FTS tax credit as a refundable mineral exploration tax of 25% on exploration expenditures for eligible individuals and companies that will be in effect until March 31, 2005; British Columbia's FTS tax credit program provided a 20% tax cut for flow-through financing for eligible grass-roots exploration; and Saskatchewan has a temporary 10% tax credit for eligible FTS investors in mineral exploration firms active in the Province where the targeted commodities were diamond and uranium (Natural Resources Canada, 2003c, p. 38-39, 48, 55-57, 71-72, 85, 90, 104-105, 111, 115).

The Federal Department of Indian Affairs and Northern Development (DIAND) and the Northwest Territories Government merged their geoscience programs and jointly managed the C.S. Lord Northern Geoscience Centre in Yellowknife. The Centre is supported by the DIAND, the Government of the Northwest Territories, and the Geological Survey of Canada. After the formation of the Nunavut Territory on April 1, 1999, a land claim settlement allocated about 40,000 square kilometers (km^2) of Nunavut as "Inuit Owned Land" where surface rights are held by Regional Inuit Associations (RIAs) and subsurface rights are held by the Inuit people and administered by Nunavut Tunngavik Incorporated. An additional 320,000 km^2 is considered to be "Inuit Owned Land" where surface rights are held by the Inuit and are administered by the RIAs and subsurface rights are retained by the Crown and administered by the DIAND. In both cases, exploration and mining are allowed and subject to permitting through the respective RIAs. Exploration for metals and petroleum has tended to move north in recent years into what is now the Nunavut Territory and has resulted in Baffin Island's Nanisivik lead-zinc mine, which is located 750 kilometers (km) north of the Arctic Circle; it was owned by Breakwater Resources Ltd. (BRL). The Inuit have been generally receptive to mining proposals as a way of bringing more business and employment into their region (Natural Resources Canada, 2003c, p. 113-116).

Federal and Provincial policies (though not entirely consistent among Provinces) are generally stable and have traditionally favored the research and information services that relate to the mining industry. The Federal Government has negotiated multiyear Mineral

Development Agreements, which fund initiatives intended to strengthen the mining industry in each region, with Provincial Governments. Environmental assessment legislation was passed in 1992, and the Federal Government has been deliberate in producing regulations to implement such law. One subsequent measure was the tax deductibility for funds set aside for the cleanup of closed mine sites, thus complementing emerging Provincial reclamation requirements.

The Canadian Securities Administrators (CSA) has finalized the National Instrument 43-101, which pertains to the "Standards of Disclosure for Mineral Projects." This instrument, which was enacted into law in early 2001, will apply to all technical public disclosures on mineral projects and will require all technical disclosures to be based on the work of a qualified person (QP). The QP is to be responsible for scientific and technical matters, which will include exploration, development, definitions of resources and reserves, and mining matters, and quality-control standards for analytical laboratories, the form of technical reports, professional supervision, corporate governance practices, regulatory oversight of the mining industry, and enforcement of securities laws.

In response to stakeholders' (mining industry, communities, and Provinces and Territories) demands for incentives on mineral exploration and deposit appraisal, the Canadian Federal Government introduced the Investment Tax Credit for Exploration (ITCE) in October 2000. This 3-year 15% nonrefundable federal tax credit was available only to investors in the FTS of exploration and mining companies; it was later extended to the end of 2004. The Prospectors and Developers Association of Canada (PDAC) and the Mining Association of Canada requested an extension of the ITCE beyond the end of 2004. This request, with the recommendation of the Mining Ministers of Canada, now will be in effect until the end of 2005. The credit is in addition to the existing 100% deduction of eligible exploration expenditures from the Federal portion of investors' income tax and is equivalent to a 136.7% exploration expense deduction. The two types of FTS investments are the "super" flow-through, or additional Federal tax credits, for "grassroots" exploration and the regular flow-through plus Provincial and Territorial harmonization initiatives. Both FTS investments will assist the sector in gaining new investment and stimulating minerals exploration activity in Canada.

The Federal Government is laying a foundation for the sector by providing sound economic fundamentals, encouraging innovation and knowledge, and promoting sustainable development. Income tax benefits to individual investors for income tax purposes and marginal tax rate will vary depending on the taxpayer's residence. Quebec continued to offer the largest tax savings for FTS investments followed by the Yukon Territory, British Columbia, Ontario, and Saskatchewan (Natural Resources Canada, 2003c, p. 27-29, 56).

Environmental Issues

The Canadian Mining Association noted (July 2004) that the Canadian Environmental Assessment Act (CEAA) put several Federal departments in a position to review mining activity, a purview that had been limited to Provincial jurisdiction. The CEAA includes many provisions that bring Federal agencies into the review process to evaluate impacts on area fisheries and navigable rivers or where explosions or public works are involved. Overlapping Federal jurisdictions have made it difficult for companies to know what they have to do to secure approval for their projects. Observers thought that if the CEAA created difficulties for raising capital, then investors might become wary of Canada's approval regime. They would invest their monies in other countries where regulations are more straightforward and transparent. In Canada, however, the Provincial and the Territorial Governments continued to support and promote exploration and deposit appraisal activities in their respective jurisdictions through various initiatives, such as fiscal incentives, resolution of land access issues, and the provision of state-of-the-art geoscientific data (Natural Resources Canada, 2003c, p. 15-16).

In a further effort to define goals, approaches, and alternatives in the name of sustainable development, the PDAC, which is a private sector organization, issued a paper, "Total Landscape Management (TLM): An Integrated Approach to Conservation Protection and Resource Development." The PDAC asserts that TLM goes beyond the growing reliance on multiple-use exclusive areas to achieve conservation objectives. This multiple-use concept, however, has produced unsatisfactory results because the complex and changing needs of the landscape require a more-comprehensive and integrated approach. The paper acknowledges that access to land and certainty of title are crucial to resource development and that biological diversity, wilderness protection, and the preservation of unique and exceptional areas are fundamental to conservation objectives. TLM prescribes management of entire ecological landscapes by using the overarching principal of conservation diversity; a system of "floating reserves" designed to accomplish protection in a constantly changing, dynamic landscape; adaptive management that allows the flexibility to accommodate new information, evolving ecosystems, and natural disturbances; and comanagement that ensures the provision of local community input. Failure to understand local realities and to involve the community constructively creates the risk of costly delays or even termination of mineral exploration and development projects owing to disruption, confrontation, and conflict over cultural, environmental, and social issues (Thomson, 2004, p. 4).

Production

In 2003, Canada was one of the leading mining countries in the world. Significant increases in the values of the output of diamond (117.5%), nickel (16.7%), iron ore (13.1%), and cement (4.1%) compared with those of 2002 kept the country's mineral industry strong and stable. Production values of metals decreased by 6.5%; nonmetals, which include diamond and structural materials, increased by 13.8%; and coal decreased by 6.6% compared with those of 2002 (Natural Resources Canada, 2004b).

Market prices played a changing role in the mineral commodity values. In 2003, the value of metals decreased to $6.9 billion from $7.4 billion in 2002, which was due to the decline in the values of zinc production by (24.3%), copper (9.7%), gold (3.9%), and stone

(2.4%) from those of 2002. Strong prices encouraged increases in the production of diamond, iron ore, and nickel. The value of output for most other metals remained at about the 2002 levels despite rebounding prices during 2003. The increase in diamond output was accompanied by higher prices. Lower zinc prices resulted in a 24% decline in zinc output (Natural Resources Canada, 2004b).

Ontario, which was the leading producer of nonfuel mineral commodities, accounted for 27.4% of the total value followed by Quebec, 18.1%; British Columbia, 14.1%; Saskatchewan, 11.7%; Northwest Territories, 8.9%; Alberta, 5.8%; Newfoundland and Labrador, 4.6%; Manitoba, 4.3%; New Brunswick, 3.4%; Nova Scotia, 1.3%; Yukon Territory, 0.2%; and Nunavut Territory, 0.1%. Although the production of fuels tended to be concentrated in the Western Plains Provinces, the output of nonfuel mineral commodities was characterized by a much wider distribution throughout Canada (Natural Resources Canada, 2004a, b).

Trade

As the world's leading exporter of minerals and metals, Canada enjoyed economic benefits from its mineral industry that included a significant contribution to its trade balance. In 2003, exports of minerals and metals (excluding crude oil and natural gas), smelted and refined metals, and mineral products earned $35.3 billion, or 12.4% of all exports ($285.7 billion); these exports represented a 5.6% decrease compared with those of 2002 ($37.4 billion). The value of exports of fuel minerals, which included coal, was $27.2 billion; this was an increase of 22.7% compared with that of 2002 and represented 9.5% of all Canadian exports for 2003 (Birchfield, 2003; Natural Resources Canada, 2003a, p. 1.16; Department of Finance Canada, 2003§; Statistics Canada, 2004b§). Included in these exports were crude minerals, fertilizers, and metals and alloys. Prominent among the crude minerals were iron ore, potash, and sulfur to the United States; copper concentrates to Japan; and iron ore and zinc concentrates to the European Union (EU). Smelted and refined metals included aluminum, copper, gold, iron and steel, nickel, silver, and zinc to the United States; aluminum and gold to Japan; and copper and nickel to the EU. Coal exports went mostly to Japan (Statistics Canada, 2004c§).

Mineral and mineral product imports, which included fuels, were valued at $42.7 billion, which was about the same level as those of 2002 ($42.6 billion). In terms of net trade, the mineral surplus, which included fuels, was valued at $5.8 billion higher than that of 2002. Total trade between Canada and the United States exceeded that of any other two countries in the world. In 2003, more than 80% of Canadian exports ($230 billion) and 70% of Canadian imports ($171 billion) were with the United States followed by Japan, United Kingdom, European Union, and Mexico (Statistics Canada, 2004c§).

Structure of the Mineral Industry

The Canadian mineral industry comprised about 3,000 domestic and perhaps 150 foreign companies, although less than 10% of these companies were actively engaged in actual mining. Major international and junior Canadian mining companies were engaged in exploration; some were in advanced stages of mine development and expansions. Companies whose corporate voting rights were at least 50% non-Canadian were considered to be foreign, although other distinctions could apply in some large companies. More than 200 mine sites, which included coal, were active (Giancola, 2003, p. 442-444). Another 3,000 mines and quarries produced sand and gravel and other construction materials. About 40 smelters and refineries, as well as other processing plants, were operating in the cement, sodium chlorate, and sulfuric acid industries. Foreign companies were subject to the same taxes as domestic companies, but repatriation of earnings was allowed.

Most of the Canadian mineral industry was privately owned with the notable exception of Government participation in potash and petroleum, but even these were in transition to private ownership. Saskatchewan owned part of several companies, such as Potash Corp. of Saskatchewan Inc. (PCS), which was based in Saskatoon, and Saskatchewan Oil & Gas Corp. Alberta owned part of Alberta Energy Co. Ltd. The proportion of Provincial Government ownership was changeable, but the trend will be toward privatization in 2004. A large proportion of the total number of mining and petroleum companies was partly publicly owned with shares trading on various exchanges in Canada and, in many cases, the United States.

Overall, the mineral industry in Canada consisted of underground and open pit mines, leaching operations, concentrators, smelters, and refineries, as well as drilling and production operations characteristic of the petroleum industry. Table 2 lists the structure of the mineral industry, by sectors, of the major mineral commodities.

In 2002 (the latest year for which data are available), employment in the mining and mineral manufacturing industries, which included coal, increased to 360,851 from 359,489 in 2001; this was a 7.2% decrease compared with that of 2000 (388,900 jobs). The total number of employees in coal, metal, and nonmetal mining and quarrying decreased by 6.1%, or 47,423, compared with the 2001 level (50,511 jobs). Employment in mining (coal, metal, and nonmetal) declined, most notably the metal sector where employment decreased to 23,944 in 2002 from 26,686 in 2001. About 1,300 people were also employed in diamond drilling and other support services incidental to mining operations (Birchfield, 2003; Natural Resources Canada, 2003a, p. 1.7-1.8).

Commodity Review

Metals

Aluminum.—Production of primary aluminum was about 2.8 million metric tons (Mt), which was an increase of 3.1% compared with that of 2002 (Natural Resources Canada, 2004a, b). This put Canada third in the world, after China and Russia, in volume of

production and first, after Russia and Venezuela, in volume of exports to the United States. In 2003, the value of Canadian production remained about the same level as that of 2002 ($4.1 billion). The country remained the second ranked primary aluminum exporter after Russia; the value of exports was $3.5 billion (Wagner, 2003a, p. 9.1-9.3; Plunkert, 2004).

Alcan Aluminum Ltd. owned about 56% of the total Canadian primary aluminum smelter capacity of 2.79 million metric tons per year (Mt/yr). Alcan owned the 400,000-metric-ton-per-year (t/yr) Alma smelter in Alma, Quebec, which required 620 megawatts (MW) of power; 270 MW came from Alcan's own grid, and 350 MW, from Provincial utility Hydro-Quebec Ltd. The company had negotiated a projected 22-year power-exchange project with Hydro-Quebec. With Hydro-Quebec furnishing additional power that Alcan may need for modernization and expansion of its six additional smelters in Quebec, Alcan projected that it would require an average market price of $1,400 per metric ton to meet its cost of capital. The new potlines would comprise 432 pots in two lines. The Alma facility will raise Alcan's overall primary aluminum capacity at all its plants to 1.9 Mt/yr from 1.56 M t/yr, and Canada's production capacity will increase to 3 Mt/yr in 2005 (Wagner, 2003a, p. 9.1-9.4).

Cobalt.—Mine production of cobalt amounted to 4,304 metric tons (t), which was a decrease of 16.4% compared with that of 2002 (5,148 t). This resulted from a 3-month production interruption owing to a labor dispute at Inco's Ontario operations; a new 3-year agreement was signed in August 2003. In spite of that decrease in output, the value of shipments increased by 3.2% to $51.0 million in 2003 (1,743 t) from $49.4 million in 2002 (2,065 t). Cobalt prices improved in parallel to the increase in the value of nickel. Rising demand for cobalt for alloys, catalysts, magnets and batteries, and even pigment, however, focused new attention on cobalt resources in Canada led by the Voisey's Bay discovery of at least 40,000 t (Natural Resources Canada, 2004a; Inco Limited, 2003§). The expectations to proceed with a number of new hydrometallurgical nickel-cobalt laterite plants would further increase cobalt prices in the open market. The higher prices of the mid-1990s would be rather difficult to sustain in the future given the current market conditions and expectations. In 2002, Canadian imports and exports of cobalt were valued at $24.5 million and $14.6 million, respectively, which resulted in net imports of cobalt of $9.9 million (McCutcheon, 2003b, p. 38.14).

Columbium (Niobium).—Mine output content decreased by 2.0% to 3,270 t in 2003 from 3,333 t in 2002. The country remained the second ranked columbium (niobium) producer after Brazil. Niobec, which was the only operating columbium (niobium) mine in North America, was jointly owned (50% each) by Cambior Inc. and the operator Sequoia Minerals Inc. Located near Chicoutimi, Quebec, the mine ranked as the world's third ranked producer. The Niobec Mine's life was estimated to be about 18 years on the basis of current reserves of 22.6 Mt at an average grade of 0.65% Nb_2O_5 and a mill capacity of 3,500 metric tons per day (t/d). The equal partners have undertaken a study of the feasibility of increasing production by 40% in at least two steps. Included in the upgrade would be an expansion of the crushing and grinding circuit by 20% to 50%. Columbium (niobium) is used primarily as an alloying agent in specialty steels (Cunningham, 2004; Natural Resources Canada, 2004a; Cambior Inc., 2004§).

Copper.—Mine output of copper decreased by 8.5% to 534,287 t in 2003 from 584,195 t in 2002, which reflected the decline in world copper prices that resulted in a drop in value to $1.30 billion in 2003 from $1.44 billion in 2002, or a 9.7% decrease (Natural Resources Canada, 2004a, b). Canada exported $2.5 billion worth of copper during 2002 (McCutcheon, 2003a, p. 22.46).

After rising to a peak in 1998, the decline of copper prices began in the third quarter of 2000 and continued through 2001. A decline in economic activity in the copper-user countries in Asia, Europe, and the United States; weak market conditions; high copper inventories; a sluggish world economy; and a poor economic outlook resulted in the reduction, suspension, and shutdown of some copper production, such as, Highland Valley Copper's (HVC) mine that is located south of Kamloops, British Columbia (Teck Cominco Limited, 63.9%; BHP Billiton plc, 33.6%; and others, 2.5%) and where copper output was 170,400 t in 2003 compared with 181,300 t in 2002 for a decrease of about 6.0%; the temporary closure of Boliden Ltd.'s Myra Falls Mines in British Columbia, which reopened in March and produced 6,700 t of copper in 2003 compared with 13,200 t in 2002 for a decrease of almost 50%; and the permanent closure of Hudson Bay Mining and Smelting Co., Ltd.'s Ruttan Mine in Manitoba in June 2002 and lower ore grades at Falconbridge Ltd.'s Kidd Creek copper mines (Giancola, 2003, p. 409, 444; McCutcheon, 2003a; Teck Cominco Limited, 2004§). No new copper mines were scheduled to come on-stream until 2005. In 2003, HVC mined copper at an average grade of 0.39% and processed about 67.5 Mt/yr of ore to produce copper in concentrate at a cost of about $0.68 per pound (about $1.50 per kilogram) (Teck Cominco Limited, 2004§).

In 2003, Inco's Voisey's Bay project was estimated to have a life of about 30 years. The potential copper production (38,600 t) at Voisey's Bay suggested that Canada, which ranked sixth after Chile, Indonesia, the United States, Australia, Peru, and Russia, will continue to be a major world copper producer (Edelstein, 2004; Voisey's Bay Nickel Company, 2004§). At Voisey's Bay's nickel-copper-cobalt deposit, which is located on the coast of Labrador, proven reserves were estimated to be 30 Mt of ore at grades of 2.88% of nickel, 1.69% of copper, and 0.14% of cobalt and an additional 54 Mt of indicated mineral resource and 16 Mt of inferred mineral resource (Inco Limited, 2004§; Voisey's Bay Nickel Company Limited, 2004§).

Gold.—Gold output decreased by 7.2% to 141 t in 2003 from 152 t in 2002. This decrease was primarily because of closures and the suspension of mining activities by polymetallic producers and the depletion of gold reserves. The value of gold production decreased by about 5.9% to $1.6 billion in 2003 from $1.7 billion in 2002 (Natural Resources Canada, 2004a, b). Ontario produced 49%; Quebec, 21%; British Columbia, 15%; Manitoba, 4%; and the Yukon Territory, the Northwest Territories, Saskatchewan, Newfoundland, Alberta, and New Brunswick, a total of 11%. Operating gold mines accounted for 92.5% of Canada's output, and 19 base-metal mines (gold as byproduct) and numerous gold placers contributed with 6.0% and 1.5% of remaining output, respectively. Canada was the eighth ranked gold producer after South Africa, Australia, the United States, China, Russia, Indonesia, and Peru. Canada exported $2.7 billion worth of gold in various forms during 2003. The increase in the price of gold to $363 per troy ounce in 2003 from $310 per troy ounce in 2002 provided gold companies better access to risk capital, which would translate into increased

spending in exploration and the funding of new gold resources in Canada (Miron, 2003; Amey, 2004; Natural Resources Canada, 2004a, b).

Iron Ore.—Output of iron ore increased by 6.7% compared with that of 2002, and the value of production increased by 13.1% (Natural Resources Canada, 2004b). This iron concentrate comprised concentrates, pellets, and sinter from hematite and siderite ores. Canada's production came from its major iron-ore-producing companies, which included Iron Ore Company of Canada (IOC), Quebec Cartier Mining Co. (QCM), and Wabush Mines Ltd. The remaining production was from the byproduct recovery of magnetite from two base-metal smelters in British Columbia. Data for 2002 (the latest year for which data were available) gave an approximation of the proportions of pellets and sinter versus concentrates. IOC produced 14.7 Mt of ore, of which 11.6 Mt went to pelletization and the remainder, to concentrates that were not used for pellets. QCM (co-owned by CAEMI Mineração e Metallurgia S.A. and Dofasco Inc.) produced 12.0 Mt of ore, of which 8.5 Mt was used for pelletization and the remainder, sinter feed. Shipments exceeded production so that stocks were drawn down to meet demand. Wabush Mines produced almost 4.6 Mt of iron ore, which was about the same level as that of 2001 (Perron, 2003b).

In 2002, Canadian exports and imports of all classes (iron ore concentrates and agglomerates) were 25.8 Mt valued at $780 million and 6.8 Mt valued at $268 million, respectively. Improvements of economic conditions in Asia (China in particular, which was the fastest growing economy in the world) will have a marked impact on the steel and iron ore markets, which will benefit the Canadian iron ore industry. Chinese imports of iron ore increased to 111.5 Mt in 2002 from 14.3 Mt in 1990; this was about 18% of the country's annual growth rate. Exploration continued in various parts of Canada, such as Roche Bay in the Northwest Territories, the Peace River area of Alberta, and Ungava Bay and Schefferville in Quebec (Perron, 2003b).

Lead and Zinc.—Canada was the world's fourth ranked mine producer of zinc at 788,328 t of zinc and the world's sixth ranked producer of lead at 81,268 t of lead in concentrate. Zinc mine output showed a decrease of 14.7% in 2003 compared with that of 2002, and lead production decreased by 19.8% compared with that of 2002 (Natural Resources Canada, 2003c, p. 87; d; 2004a, b; Plachy, 2004; Smith, 2004). Decreased prices for zinc continued because of poor demand in Japan, slow growth in Europe, and oversupply in markets worldwide. New mine capacity in Australia, Ireland, and Peru; expansions in Chile, Peru, and the United States; increased exports from China; and weak market prices continued to take their toll with a continued increase in stock levels (Natural Resources Canada, 2003d).

In 2003, Noranda Inc.'s 72,000-t/yr-capacity operations at the Brunswick Mine, which is located near Bathurst, New Brunswick, was the leading lead producer in Canada. Teck Cominco's Trail operation, which is located in southern British Columbia, was the world's leading fully integrated smelter and refinery complex and had a zinc production capacity of 300,000 t/yr (Natural Resources Canada, 2003c, p. 89-91; d).

BRL closed its Nanisivik Mine in the Nunavut Territory in September 2002. BRL's Caribou zinc mine remained on care and maintenance; reopening depended on better metal prices. Hudson Bay was developing its Chisel North underground zinc mine at Chisel Lake, Manitoba, which is not far from Snow Lake Mine. A decline will be driven from the 140-meter (m) level of the main deposit to the north deposit for drilling and bulk sampling to confirm the surface-drill indicated resource of 2.4 Mt at a grade of 10.8% zinc. The $21 million capital investment was part of Hudson Bay's $260 million investment in the 777 deposit, which contains some 14.5 Mt of proven and probable zinc reserves, and included the refurbishment of the Snow Lake concentrator. Snow Lake's concentrates will be trucked 200 km southwest to the Flin Flon smelter. The 777 deposit was expected to enter into full production by mid-2004. The construction of a $65 million electrolytic tank house and completed work on a new zinc tank house at the Flin Flon smelter will probably increase capacity by about 35% to 115,000 t/yr from 85,000 t/yr (Natural Resources Canada, 2003d).

After closing its operations in the Matagami District of northern Quebec after the exhaustion of the Isle Dieu and Norita East zinc-copper mines, Noranda completed development of the $119 million Bell Allard zinc-copper mine, which is also located in the Matagami District. The underground operations would counter the exhaustion of Isle Dieu and Norita East. The Bell Allard Mine was expected to have a capacity of 80,000 t/yr of zinc and 5,000 t/yr of copper. Armed with local experience from two closed mines, Noranda pressed exploration in the Matagami District for further discoveries of copper-zinc deposits (Giancola, 2003, p. 265).

Agnico Eagle Mines Limited spent $104 million to complete the expansion of its LaRonde zinc mine in northwestern Quebec, which was projected to produce 52,000 t/yr of zinc in concentrates in early 2004. In northwestern Quebec, Noranda reported finding new sources of feed for milling and smelting operations in the Matagami District. A significant zinc-copper deposit of three ore zones (Equinox, Perseverance, and Perseverance West) was discovered in the existing Matagami mining camp. The Equinox deposit was 5 Mt of inferred resource with 16.8% zinc, 1.3% copper, 34 grams per metric ton (g/t) silver, and 0.4% g/t gold. Work continued to develop the four levels of polymetallic ore zones on the lower part of the Penna Shaft (Giancola, 2003, p. 20).

In 2002, Canadian exports and imports of lead and zinc were 190,300 t valued at $215.8 million and 189,700 t valued at $215.9 million of lead and 1.1 Mt valued at $1.3 billion and 319,000 t valued at $207.5 million of zinc, respectively (Natural Resources Canada, 2003c, p. 101-102; d).

Magnesium.—Canada was the second ranked producer of primary metal in the world after China. In 2003, Canada's metal output was 54,000 t, or 38.6% lower than that of 2002 (88,000 t); this drastic reduction was the consequence of low magnesium prices (less than the break-even price of $1.30 per pound), which lead to Magnola Metallurgy Inc.'s (Noranda Inc., 80%, and Société Générale de Financement du Québec, 20%) interim closure of its 58,000-t/yr commercial magnesium plant in Danville, Quebec, in April 2003. After that time, Timminco Ltd.'s Haley Station (6,000 t/yr) in Ottawa, Ontario, and Norsk Hydro Canada Inc.'s Bécancour plant (48,000 t/yr) in Quebec will be the only two operating magnesium smelters in Canada. In 2002, Canadian exports and imports of magnesium were 71,200 t valued at $266.7 million and 35,000 t valued at $114.4 million, respectively (Wagner, 2003b; Kramer, 2004).

Nickel.—Mine output decreased by about 14.0% from that of 2002. Despite this decline, higher prices caused the value of nickel to increase by 4.2%, or $1.4 billion, compared with that of 2002. Nickel was the second most valuable metal, following gold, produced in Canada during the year (Natural Resources Canada, 2004b).

Falconbridge was the third ranked producer of nickel in the world. Its operation included the Raglan nickel mines and mill in northern Quebec, the Sudbury operations (four mines, a mill, a smelter, and an acid plant) in Ontario, a refinery in Norway, and a mine and smelter in the Dominican Republic (McCutcheon, 2003b, p. 38.5-38.7).

Falconbridge's four mines (Craig, Fraser, Lindsley, and Lockerby) in Sudbury, Ontario, plus the Raglan Mine in Quebec produced 53,500 t of nickel in concentrates, which was smelted in the firm's smelter near Sudbury. The matte, which contained 50% nickel from the smelter, was shipped to Falconbridge's Nikkelverk refinery in Norway where cobalt, copper, nickel, and precious metals were recovered. The $360 million Raglan operation was scheduled to produce concentrates of about 20,800 t/yr of nickel and 5,200 t/yr of copper. Raglan concentrates were to be shipped from Deception Bay, which is located 100 km north of the mine, to Quebec City and to continue by rail to Falconbridge's Sudbury smelter. Falconbridge's exploration at the Nickel Rim South property resulted in an increase resource of 6.3 Mt at a grade of, in order of value, 1.7% nickel, 3.4% copper, 2.2 g/t platinum, 2.5 g/t palladium, and 1.5 g/t gold by early 2003 (McCutcheon, 2003b, p. 38.5).

In 2003, Inco produced nickel from nine underground mines (seven were located in Sudbury, Ontario, and two, in Thompson, Manitoba) and operated nickel mills, smelters, and refineries in Sudbury, which produced 71,000 t of finished nickel; the Thompson operations produced 47,000 t. Inco produced refined nickel and nickel oxide sinter (Inco Limited, 2004§).

The Government of Newfoundland and Labrador granted the mining lease to Inco on September 30, 2002, to develop the Voisey's Bay deposit on a $1.9 billion plan. While the exploration program progressed at the Voisey's Bay site, Inco estimated that proven and probable reserves were 30 Mt at grades of 2.85% nickel, 1.68% copper, and 0.14% cobalt; indicated resources, 54 Mt at grades of 1.53% nickel, 0.70% copper, and 0.09% cobalt; and inferred resources, 16 Mt at grades of 1.60% nickel, 0.80% copper, and 0.10% cobalt. Of the resources noted, 95 Mt at grades of 1.55% nickel, 0.69% copper, and 0.08% cobalt would be minable by underground mining methods, and 5 Mt at grades of 1.31% nickel, 1.03% copper, and 0.07% cobalt would be minable by open pit (Inco Limited, 2004§; Voisey's Bay Nickel Company, 2004§).

Inco had an agreement with Nuinsco Resources Ltd. of Toronto whereby Nuinsco can acquire 100% of Inco's Mel nickel property in the Thompson area of Manitoba by spending $6 million during a 5-year period to delineate 1 Mt at a grade of from 1.6% to 2.0% nickel for open pit by August 31, 2004. Inco could reacquire up to 51% of equity on the Mel project (Inco Limited, 2004§).

In 2002, Canadian exports and imports of nickel were valued at $1.7 billion and $517 million, respectively, which results in net exports of Canadian nickel of almost $1.2 billion (McCutcheon, 2003b, p. 38.19).

Platinum-Group Metals.—Mine production of PGM decreased by about 24.0% compared with that of 2002. Despite the almost 14.0% increase in the price of world nickel, its use increased by 6.9% owing to the higher demand for use mostly in autocatalysts and electronics in 2002. Platinum alloys tend to be used in jewelry; platinum, palladium, and copper-gold-silver alloys are used in dentistry. Most production of PGM has been from Falconbridge's and Inco's nickel-cobalt mines in Sudbury and a smaller amount from Inco's Thompson Mine in Manitoba (Birchfield, 2003; Natural Resources Canada, 2004b).

The nickel sulfide ores yield creditable byproducts such as, in order of the potential value of production, copper, cobalt, gold, silver, PGM, selenium, tellurium, sulfuric acid, and liquid sulfur dioxide. As an approximation based on past experience, Inco's ratio of PGM produced worked out to about 12 to 7.6 to 1 for palladium, platinum, and rhodium, respectively. Although rhodium amounted to only slightly more than one-twentieth of the PGM, its prices have traditionally been significantly higher than those for other members of the group; it has traded between $800 and $2,000 per ounce in recent years (2001 and 2002). Canada ranked third behind South Africa and Russia in world platinum production and fourth after Russia, South Africa, and the United States in world palladium production (Hilliard, 2004a).

Silver.—Canada ranked seventh in world silver production after Mexico, Peru, China, Australia, the United States, and Chile (Hilliard, 2004b). Canadian silver production has been largely a coproduct of base-metal and gold mining and, therefore, subject to whatever mining incentive applied to the major product, whether copper, gold, and/or lead and zinc. Accordingly, silver output suffers when mines close or go on suspension for reasons that involve supply, demand, and pricing for the major mineral commodities. Mine production of silver decreased by almost 7.0% compared with that of 2002; the value of this production decreased by about 12.8% (Natural Resources Canada, 2004b).

Titanium.—QIT-Fer et Titane Inc. (QIT) of Quebec, Canada, was wholly owned by Rio Tinto plc of the United Kingdom (QIT-Fer et Titane Inc., 2004a§). QIT's metallurgical complex in Sorel-Tracy, which was the only one of its kind in the world, smelted ilmenite, which is a titanium dioxide and iron-bearing ore. The smelted ore is transformed into titanium dioxide and iron. The primary product is a titanium dioxide feedstock to make pigments for paints, surface coatings, plastics and paper, and iron and zircon by products. QIT's proprietary process technology had a production capacity to supply sulfate (1.1 Mt/yr of SORELSLAG titanium slag) and chloride (250,000 t/yr of UGS titanium slag, which was QIT's newest product) pigments. SORELSLAG has a titanium dioxide content of about 80%, which is sold to pigment producers that use the sulfate process. UGS slag, which contains 94.5% of titanium dioxide, was supplied to the growing market of pigment producers that use the chloride process. To meet such potential demand, the UGS plant was expected to increase production to 600,000 t/yr from its current capacity of 250,000 t/yr (QIT-Fer et Titane Inc., 2004b§).

The company planned to extract 3 Mt/yr of ore. Reserves and reserve base are ilmenite. Canada, which exported 79,100 t of titanium dioxide pigment to the United States, ranked third as a titanium supplier to the United States following South Africa and Australia (Gambogi, 2004).

Uranium.—Production of uranium (U) in 2003 amounted to 9,906 t U, which was a decrease of almost 23% compared with that of 2002 (12,855 t U); this was mainly due to reduced output from the Rabbit Lake production center, older mines being shut down in the Elliot Lake District of Ontario, and ongoing deposit appraisals in the Cigar Lake, the Cluff Lake, and the Key Lake districts of Saskatchewan (table 2).

In 2003, the value of uranium production decreased by almost 18%; the uranium spot market price was, however, remarkably stable during 2002 and 2003. This situation had been brought about by ample inventory supplies compared to spot demand as Government stockpiles in Russia and the United States continued to supply uranium to the market and the focus on cleaner air and climate change that has stimulated public debate on energy policy, which created a more favorable attitude for nuclear power. As the world's leading supplier of uranium, Canada was well-placed in terms of resources such as reserves, mining labor experience, and technology to maintain this position considering the expected improvement on longer term world demand (Vance, 2003; Natural Resources Canada, 2004a, b).

In 2003, Canada's known recoverable uranium resources totaled 439,000 t U, or an almost 3% decrease compared with that of 2002 (452, 000 t U). Canadian uranium producers in northern Saskatchewan remained well-positioned to capitalize on prospects for further nuclear power development in the United States and any market upturn because the transition to new production was being centered on tapping high-grade low-cost uranium deposits in Canada. Continued success in bringing environmentally sustainable operations, such as the Cigar Lake Mine, would ensure that Canada remains the world's most significant uranium supplier (Vance, 2003).

Industrial Minerals

Asbestos.—Canadian asbestos production and value decreased almost by 1.0% and 17.4%, respectively, compared with those of 2002; these decreases were the result of competition for market share with China and Russia and a contraction in demand because of the adoption of governmental regulations by a number of countries owing to human health concerns (Natural Resources Canada, 2004a). Chrysotile is the only form of asbestos in the serpentine group; the amphibole group consists of actinolite, amosite, anthophyllite, crocidolite, and tremolite forms. Of these minerals, chrysotile is the least hazardous to human health and is the only form produced in Canada. After Russia and China, Canada was the third ranked producer of asbestos and supplied about 96% of U.S. demand. Total shipments for 2002 were estimated to be 241,000 t at a value of $98 million (Birchfield, 2003; Perron, 2003a; Virta, 2004). China's asbestos production was almost exclusively short fibers for asbestos cement and replaced Canada as the second ranked producer and meeting demand in Asian markets, which could eventually threaten Russia's leading position. As a result of the European ban movement and regulatory changes in other developed countries, chrysotile asbestos use will remain low for the foreseeable future. In some developing countries, the benefits and safety of chrysotile-cement products continued to be recognized despite increasing competition from substitute fibers, PVC, and galvanized steel. The chrysotile-cement pipes are essential for water transportation and irrigation because of aggressive soils and economic conditions, which are not conducive to substitute products in developing countries, yet. The introduction of new chrysotile-containing products to address health concerns and the gradual recognition by regulatory bodies of the potential toxicity of the substitute fibers may turn chrysotile asbestos markets around in the medium term (Perron, 2003a). Marginal gains were expected in Latin American consumption of Canadian chrysotile; Asia, which was already a significant market (taking more than 50% of exports), was seen as expanding the demand for longer Canadian fibers.

The Canadian asbestos industry was concentrated in Quebec. Production came from the Black Lake open pit and the Bell underground mines, which are located in Quebec and operated by LAB Chrysotile, Inc., and the Jeffrey Mine, which is located near Asbestos Town, Quebec, and operated by Jeffrey Mine Inc. (Perron, 2003a, p. 18.1). The production of metallic magnesium from asbestos mine waste materials should improve the economics of the asbestos industry and create better overall labor expectations particularly in Quebec, where decreased production has taken its toll.

Cement.—Production of cement increased by about 2.6% from that of 2002 (13.7 Mt) with a corresponding value increase of 4.1% from that of 2002 ($1.0567 billion). On the basis of preliminary data, shipments of cement in 2002 were estimated to have been 13.2 Mt at a value of $993 million compared with 13.0 Mt at a value of $964 million in 2001 (Vagt, 2003a; Natural Resources Canada, 2004a, b). This trend reflected continued strengthening of the export market in the midst of declining prices. The weakening of the Canadian dollar versus the U.S. dollar made Canadian cement prices attractive to U.S. consumers. U.S. antidumping duties against gray portland cement and clinker from Mexico remained in effect in 2002 (Vagt, 2003a). Total U.S. imports of cement, which excluded clinker, totaled 21 Mt in 2003 (van Oss, 2004). Canada and U.S. trade of cement and clinker has varied from year to year depending on construction activity. In 2002, cement exports to the United States amounted to 4.4 Mt, which was about one-third of total Canadian production. For the immediate future, the success of Canadian cement producers seems to be based significantly on exports to the United States and, hence, upon the prospects for U.S. economic growth. Canadian growth and construction, particularly in Ontario, which was the leading cement market, will play the key role in determining a balance between domestic and U.S. consumption. According to the Canadian Construction Association, cement production was expected to be marginally higher mainly on the basis of lower interest rates and an increase of about 4% in the value of infrastructure to about $81.2 billion. Also, the "Infrastructure Canada Program," which involved Federal, Provincial, Territorial, and Municipal Governments, will contribute about $4 billion across Canada in the coming decade (Vagt, 2003a).

The influx of Asian cement to the United States negatively affected Canadian exports between 1999 and 2002. The fact that Canada had been the major exporter to the United States kept Canadian cement kilns operating at high rates throughout the past decade and allowed for gains in pricing. From 1999 through 2002, the United States' main import sources for hydraulic cement and clinker were

Canada (19%), Thailand (18%), China (12%), Venezuela (7%), Greece (6%), and others (38%) (International Cement Review, 2003, p. 29; van Oss, 2004).

Diamond.—The value of diamond production continued to maintain Canada's mineral industry healthy in 2003. Production of diamond increased by almost 127% to 11.2 million carats from that of 2002 (4.937 million carats) with a corresponding value increase of 117.4% to ($1.2 billion) in 2003 from that of 2002 ($552 million). In 2003, diamond mining in the country completed its fifth full year of production; diamond has become Canada's third ranked nonfuel mineral commodity in terms of value output after gold ($1.6 billion) and nickel ($1.4 billion). The opening of the Diavik diamond project in 2003 and the startup of the Snake Lake project in 2008 will add to Canada's stature as a major producer of diamond worldwide. Canada's diamond output was 15% of world production and Canada was the third ranked producer by value following Botswana and Russia (Natural Resources Canada, 2004a, b; Law-West, 2004§).

The Ekati Mine, which was a joint venture among BHP Billiton Diamonds Inc. (80%), BHP Billiton Group of Australia (owner), and Charles Fipke and Stewart Blussom (each with 10%) and was located in the Northwest Territories, was Canada's first underground diamond mine and commercial producer of diamond. It continued to perform very well during 2002 and 2003. Production grades and diamond quality at Ekati were, however, declining as the mine exhausts. BHP Billiton Diamonds announced the expansion of the Ekati Mine's expansion, which was called the Panda Underground Project, at a cost of $182 million. Initial output was expected to begin in early 2005, and full production of 4.7 million carats, in early 2006. BHP Billiton had chosen not to renew its 3-year rough diamond contract with De Beers of South Africa through its subsidiary De Beers Diamond Trading Company of South Africa (Law-West, 2003, p. 23.1; Antwerp Facets Online, 2004a§; BHP Billiton Diamonds Inc., 2004§).

First production from the second Canadian diamond mine, the Diavik Mine, which is located in the Northwest Territories, began in January 2003. The Diavik Mine was an unincorporated joint venture between Diavik Diamond Mines Inc. (60%) (a wholly owned subsidiary of Rio Tinto) and Aber Diamond Mines Ltd. (40%) (a wholly owned subsidiary of Aber Diamond Corporation of Toronto, Ontario). The joint venture received its regulatory permits to allow construction to begin at the $930 million mine site and proceeded with plans for an about 8-million-carat-per-year operation (Law-West, 2003; Diavik Diamond Mines Inc., 2004§).

The Diavik diamond project is located about 35 km southeast of Ekati and 300 km northeast of Yellowknife in the Northwest Territories. The project would mine four separate kimberlite pipes. At least 90% of Diavik's production was estimated to be of gem quality. The diluted proven and probable reserves are estimated to be 25.6 Mt of ore at a grade of 4.0 carats per metric ton. The Diavik Mine was expected to produce about 101.5 million carats at an average value of $62 per carat during its productive life of about 13 years (Law-West, 2003, p. 23.1-23.2).

The Government of the Northwest Territories signed three agreements with De Beers Canada Mining Inc. (owner of the Snap Lake project)—the Environmental Agreement (EA), the SocioEconomic Agreement (SEA), and the Support the Secondary Diamond Industry—to ensure sustainable development in the Northwest Territories. The EA will oversee the environmental management of the Snap Lake project, and the SEA included commitments to training (literacy followed by apprenticeships) and establishment of the De Beers' socioeconomic monitoring agency. This project will be De Beers' first mine outside of Africa and the first time that kimberlite dykes will be mined on a large scale. The Snap Lake project received its final environmental permit in June 2003 and was expected to produce about 1.53 million carats during 20 years of mine life at a cost of $1 billion (Law-West, 2003, 2004§; Antwerp Facets Online, 2004b§).

In June 1999, the first diamond cutting and polishing factory in the Northwest Territories began commercial production. Sirius Diamonds N.W.T. owned and operated the factory, and rough diamonds were being supplied by BHP Billiton. Tiffany & Co. began construction of a cutting and polishing facility in Yellowknife in mid-2002. The company had an agreement with Amber Diamond Corporation to purchase up to $50 million per year of rough diamonds and expected to employ a maximum of 75 workers (Law-West, 2003, p. 23.1; Natural Resources Canada, 2004a, b).

BHP Billiton officials reported that the quality of diamond recovered to date from the five kimberlite pipes at their Lac de Gras property compared favorably with the best pipes in other parts of the world; the property is located about 300 km northeast of Yellowknife. The five pipes, in order of potential, were located under Panda, Koala, Misery, Fox, and Leslie Lakes and would be mined during a 30-year period. The centralized processing plant, which is located southwest of the Koala pit, was to receive 9,000 t/d of ore during the first 9 years of operation and 18,000 t/d thereafter. The cutoff grade would be 0.01 carat. Processing was expected to involve mainly crushing, scrubbing, and dense-media separation, as well as high-intensity magnetic separation, x-ray concentration, and sorting. The construction phase workforce would reach 1,000 at its peak; after that, about 650 workers would be employed during production. Future output was projected to be from 3.5 million to 4.5 million carats per year, or about 5% of the world's diamond supply. Capital investment was to be in excess of $360 million, but observers expected that at least $4 billion would eventually be spent in association with the project (Natural Resources Canada, 2004a).

A feasibility study was completed in June 2003 for Tahera Diamond Corporation's Jericho diamond project, which is located in Nunavut. The project was undergoing environmental assessment, which was being conducted by the Nunavut Impact Review Board. A decision for the permitting process was expected by early 2004. The study indicated that 3.0 million carats could be produced during an 8-year mine life. The Jericho project was thought to contain about 7.1 Mt with 0.84 carat per metric ton of diamond as total resources (Law-West, 2003; Tahera Diamond Corporation, 2004§).

More than 500 companies, off and on, have been exploring for diamond, especially in the Northwest Territories, but also in Alberta, British Columbia, Labrador, Manitoba, Ontario, Quebec, and Saskatchewan. The field seemed to be narrowing somewhat as various kimberlite pipes proved disappointing upon testing. BHP Billiton has supported the establishment of a diamond-valuation facility in a community in the Northwest Territories to be used for training, basic sorting, and valuation for Government royalty purposes. This

could lead to more-skilled and more-detailed sorting that would afford sales to qualified manufacturers in the northern region at prices, terms, and conditions similar to BHP Billiton's other marketing arrangements in Europe. In 2003, the First Canadian Diamond Cutting Works in Montreal became Canada's first fully integrated cutting and polishing factory with the aim of handling Canadian diamond production at a lower cost than European competitors; artisans were brought over from Belgium.

Canada joined with 50 other countries in implementing the Kimberley Process Certification to control the trade of rough diamond on January 1, 2003,. Canada's Parliament passed the Export and Import of Rough Diamonds Act and regulations, which provided the Government with the authority to control trade of rough diamonds, which must be reported to the Minister of Natural Resources Canada, who is Canada's export and import authority for rough diamonds (Law-West, 2003, p. 23.1-23.2).

Gypsum and Anhydrite.—Production of gypsum and anhydrite decreased by 6.7% to 8.3 Mt in 2003 from 8.9 Mt in 2002. On the basis of preliminary data, domestic sales of natural gypsum in 2002 were estimated to have been 4.7 Mt at a value of $2 million compared with 2.3 Mt at a value of $1.6 million in 2001. The reported 104.3% increase in sales was due to increased construction activity in Canada (Vagt, 2003b; Natural Resources Canada, 2004a, b).

Production has been mostly by Canadian subsidiaries of British and U.S. companies, such as National Gypsum (Canada) Ltd. and USG Corp., and governed by demand for wallboard manufacturing for all building categories by consumers in Canada and the United States.

Nova Scotia and Newfoundland and Labrador produced the bulk of Canadian gypsum with lesser amounts from, in order of commodity value, Ontario, Manitoba, and British Columbia. Although gypsum occurs widely in Canada and the world, the high unit weight, low unit cost, and vulnerability to damage of wallboard combine to give gypsum products a relatively high in place value, which discourages long-distance transportation. Instead, gypsum industries tend to develop in localities that serve developing construction requirements. As with the cement industry, gypsum production in Canada and the United States tends to develop in populous areas on both sides of the border in localized cross-border competition rather than among all the Provinces or all the States.

Production data for anhydrite are combined with those for gypsum but make up only about 2% or 3% of the total for the two materials. Heavier than gypsum and about twice as hard, anhydrite was produced in Nova Scotia by Fundy Gypsum Co. Ltd. at Wentworth and Little Narrows Gypsum Co. Ltd. at Little Narrows. In 2003, Canada was the world's third leading producer of gypsum after the United States and Iran (Vagt, 2003b; Olson, 2004).

Potash.—The dominant potash product is potassium chlorite (KCl), which is reported as potassium oxide/oxide of potash (K_2O) equivalent. Potash production totaled more than 9.1 Mt, which was a 9.2% increase compared with that of 2002. Value of production increased slightly to about $1.65 billion in 2003 from $1.63 billion in 2002. Most of the output came from mines in Saskatchewan, and about 5% came from New Brunswick. Canada has probably the largest known potash resource, which has been estimated to be 56 billion metric tons (Stone, 2003b; Natural Resources Canada, 2004a, b).

Canada was the world's leading producer and exporter of potash in 2003. Most Canadian potash was exported to the United States (55%), Asia (29%), Latin America (11%), Australia (3.5%), and Western Europe (1.5%). Exports to the United States have risen steadily to satisfy agricultural needs, but lower prices for grains and decreased production in the United States have lessened the need for fertilizers. Exports to Asia, which climbed owing to an increase in shipments to China, accounted for about one-third of all seaborne exports of potash from Canada.

The United States imported 4.5 Mt of potash, and 93% of its total needs were dominantly provided by Canada between 1999 and 2002. The six countries that dominated production with 87% of the total worldwide were, in order of production, Canada, Russia, Belarus, Germany, Israel, and the United States (Stone, 2003b; Searls, 2004).

PCS, which was based in Saskatoon, Saskatchewan, was one of the world's largest provincially owned potash producers with six Canadian operating divisions (Allan, Cory, Lanigan, New Brunswick, Patience Lake, and Rocanville). PCS also owned 25% of the reserves at Esterhazy, Saskatchewan, and also had one potash operation in Chile. PCS's production milling capacity was estimated to be 8.2 Mt/yr of K_2O equivalent, which was equal to 61% of Canada's total potash capacity (Stone, 2003b).

Sulfur.—Production of all forms of sulfur increased slightly by 1.6% compared with that of 2002. Sulfur from smelter gases decreased by 16.2% to 589,000 t, and sulfur from natural gas, crude petroleum, and byproducts increased by about 3.2% to 7.9 Mt compared with those of 2002. Smelter-gas sulfur is converted to sulfuric acid. No Canadian production was derived from Frasch mining (Natural Resources Canada, 2004a, b).

With a projected 15% share, Canada maintained its position as the world's second ranked producer of sulfur after the United States and remained a leading exporter with roughly a 38% share of world trade in sulfur. Most sulfur production was in, in order of amount, Alberta, Ontario, Quebec, and Saskatchewan. Other Provinces produced small amounts of sulfur, mostly from oil refineries (Morel-à-l'Huissier, 2003; Ober, 2004).

Mineral Fuels

Coal.—Although coal production was still declining from the record high of about 78.9 Mt in 1997, it decreased by 6.7% to 62.2 Mt compared with that of 2002. The total value of production was $1.5 billion, which was an increase of 6.6% compared with that of 2002 and about 18% compared with that of 1997 because of a progressively lower conversion rate for the Canadian dollar (Natural Resources Canada, 2004a, b). In 2003, fewer than 20 coal mines were operating in Canada, and the number was decreasing. At the same time, increased diversification and expansion into foreign markets were called for as a means to survive. In 2002, Canada accounted for only about 2% of the world's coal production; it exported less than one-half of that production, thus making it the world's fifth ranked exporter after Australia, the United States, China, and South Africa. All exports were from the lower cost

exporters in western Canada; metallurgical coal remained the country's major export (25.3 Mt). Domestic coal consumption remained high at about 54 Mt, and much of the eastern Canadian demand was being supplied by imports. The Appalachian region of the United States and the Cerrejón coal mine of Colombia were supplying bituminous coal for the Canadian steel and electricity industries, and Western U.S. subbituminous coal was being delivered into Manitoba and Ontario. In 2002, Canadian coal exports amounted to 25.3 Mt valued at $1.2 billion, and imports of coal into Canada were about 22.7 Mt valued at $781 million, of which the United States supplied more than 8 Mt and Colombia furnished the remainder (Stone, 2003a; Natural Resources Canada, 2004a, b).

The Luscar Energy Partnership's Luscar Coal Ltd., which was Canada's leading coal producer, operated surface mines in Alberta (Coal Valley, Obed Mountain, Highvale, Paintearth, Sheerness, Whitewood, and Genesee) and Saskatchewan (Poplar River, Boundary Dam, and Bienfait). They have a combined production capacity of 40 Mt/yr of bituminous, subbituminous, and lignite thermal coal used mainly for domestic electric power generation (Stone, 2003a, p. 20.1).

Canadian coal demand in 2002 was estimated to be about 60 Mt. Twenty-eight coal-fired electricity-generation plants used about 90% of coal, and the remaining 10% was used by the steel industry. Ontario and eastern Canada relied largely on U.S. imports of thermal coal and domestic supplies (Stone, 2003a, p. 20.4). That Canada was a major exporter and a major importer of coal reflects transportation costs between mines and consumers and is one more example of the natural integration of Canadian and U.S. interests in mineral commodities; others include cement and gypsum.

In late 2002, Canada ratified the Kyoto Protocol, which limits emissions of greenhouse gases and carbon dioxide. The ratification would impact future Canadian coal usage; the Canadian Government and the coal industry have begun to increase research and development into new technologies and greenhouse gas emission mitigation (Downing, 2003).

Natural Gas.—The value of natural gas ($14.0 billion) decreased by 3.9% compared with that of 2002, and natural gas byproducts ($2.1 billion) decreased by 2.1% compared with that of 2002; both products, however, responded to supply and demand imbalances and decreased prices. Canada ranked third in the world after Russia and the United States in output of natural gas. Increasingly, the production of natural gas has played a major role in the mineral economy of Canada and has had a palpable effect on the GDP. Gross output decreased to about 193.3 billion cubic meters from 200.9 billion cubic meters in 2002, 200.7 billion cubic meters in 2001, and 195.5 billion cubic meters in 2000, as a result of natural gas consumption in the United States, which was the world's leading consumer, decreasing to about 629.8 billion cubic meters from 661.9 billion cubic meters in 2002, or by almost 5% (Natural Resources Canada, 2003a, p. 320; BP p.l.c., 2003a§). Marketed gas is gross production minus reinjected gas, shrinkage, and producer consumption (plant use).

About 98.6 billion cubic meters of natural gas, or roughly 16% of the U.S. supply, was exported to the United States in 2003. Gas exports to the United States were expected to increase to about 100 billion cubic meters by 2006 in anticipation of the increasing inability of U.S. domestic production to meet demand. In 2003, Canada's natural gas proved reserves were projected to be about 1.7 trillion cubic meters, which remained about the same level as that of the preceding year (Natural Resources Canada, 2003a, p. 320-322; BP p.l.c., 2003a§).

Exploration for new discoveries of natural gas continued in Alberta and Saskatchewan that began at least two decades ago. In 2000, Chevron Canada Resources Ltd. (a unit of ChevronTexaco Corp.) had one of the largest natural gas strikes in recent history near Fort Laird, Northwest Territories, where projections by the company showed between 11.3 billion and 17.0 billion cubic meters (400 billion and 600 billion cubic feet) of gas in place in more than 400 m of pay zone. Accessing Canada's abundance of fuels, particularly petroleum in northern Alberta and natural gas in the Northwest Territories, has become economically feasible because of new technology and rising fuel prices, particularly, in the United States [from $3.33 per million British thermal units (Btu) in 2002 to $5.63 per million Btu in 2003]. Opposition to natural gas exploration, production, and transmission, however, has grown in recent years. Environmental groups opposed construction of proposed pipelines to feed demand in the United States, and the Rocky Mountain Ecosystem Coalition attempted to slow the expansion of natural gas exploration and production activities in northern Alberta. A National Energy Board report, which assessed supplies and demand to 2025, put known natural gas reserves in Canada's "northern frontier" at 680 billion cubic meters (24 trillion cubic feet) with estimated reserves at 4.8 trillion cubic meters (170 trillion cubic feet) (BP p.l.c., 2003a§). The United States consumed almost 609 billion cubic meters (21.5 trillion cubic feet) per year of gas, and demand was expected to grow by about 2% per year for the next 20 years (Washington Times, 2001).

Crude Petroleum.—Production of petroleum reached a new record high of 907.0 million barrels (Mbbl) in 2003 compared with 861.7 Mbbl in 2002; this was an increase of about 5.3%, which was mostly the result of the Athabasca oil sands new production (600.1 Mbbl) in Alberta and increased offshore Newfoundland and Labrador production (121.4 Mbbl) in 2003. The value of the production was $26.1 billion in 2003 compared with that of 2002 ($24.8 billion), which reflected that the oil prices in 2003 were the highest in the past 20 years (average $28.83 per barrel) and that oil consumption grew by almost 1.5 million barrels per day (Mbbl/d) worldwide. In 2003, petroleum production by the Organization of the Petroleum Exporting Countries (OPEC) increased substantially by almost 1.9 Mbbl/d. Saudi Arabia's production increased by more than 1.0 Mbbl/d. Canada and Mexico were the only non-OPEC countries that increased oil production by more than 100,000 barrels per day (BP p.l.c., 2003b§; Statistics Canada, 2004a§).

In 2003, crude petroleum exports and imports increased by 5.5% and 3.1%, respectively, compared with those of 2002. Exports amounted to 62.1% (566 Mbbl) of the total crude oil production, which was mostly the result of the strong demand from the United States. Canadian imports amounted to 331 Mbbl. Significant volume of crude petroleum was supplied by, in order of amount, Norway, the United Kingdom, and Algeria; these three countries provided almost 64.0% of the total (BP p.l.c., 2003b§; Statistics Canada, 2004a§).

Reserves

Table 3 lists the levels of Canadian reserves of copper, gold, lead, molybdenum, nickel, silver, zinc, and other selected mineral commodities on or about January 1, 2004. Data are shown in terms of metal contained in ore for the base and precious metals or recoverable quantities of other mineral commodities, which included industrial minerals and mineral fuels. These mineral reserves represent "proven" and "probable" categories and exclude quantities reported as "possible." Reserves were defined as being well-delineated and economically minable ore from mines committed to production.

Yearly changes in assessment of reserves are, in simplest terms, the arithmetic result of additions to reserves, deletions from reserves, and production. A complication in Canada is that a large number of mines produce more than one metal, thus necessitating close attention to market price and processing costs for two or possibly several mineral commodities simultaneously to enable production as coproducts.

During 2001 and 2002, reserves of the leading base and precious metals increased significantly; for example, copper, 19%; nickel, 15.8%; zinc, 7.8%; and gold, 5.6%. The only exception was lead, which decreased by 13.5%. During this period, gold reserves tripled to more than 1,500 t from about 500 t as rising prices and the possibility of more price increases provided a strong incentive to exploration. Silver reserves more than doubled to about 47,000 t from about 17,000 t during the same period (Reed, 2003).

Reserves of major metals were distributed unevenly throughout Canada and were the result mostly by mineralization of the Precambrian shield, the Rockies (Cordillera), and the Coast Ranges. Several Provinces dominated the reserves position in terms of proven and probable minable reserves of major metals. From east to west, New Brunswick had 76% of the lead reserves, 35% of the zinc, and 25% of the silver; Quebec had 26% of the zinc, 20% of the gold, 18% of the silver, 10% of the nickel, and 9% of the copper; Ontario had 72% of the nickel, about 51% of the gold, 50% of the copper, 22% of the silver, and 18% of the zinc; Manitoba had 18% of the nickel, 6% of the zinc, and 4% each of copper and gold; and British Columbia had 100% of the molybdenum, about 35% of the copper, 32% of the silver, and 19% of the gold. Future discoveries will alter the distribution of reserves among the Provinces and the Territories (Reed, 2003).

Infrastructure

With a total land (9.09 million square kilometers) and freshwater (891,163 km^2) area of about 9.9 million square kilometers, which is slightly larger than the United States, Canada had networks of highly developed infrastructure and vast areas of trackless wilderness (Statistics Canada, 2004d§). The country had 902,000 km of roads that comprised 318,400 km of paved highways, which included 16,600 km of expressways and 584,000 km of unpaved gravel or other loose-surface roads. Bulldozed temporary roads have been established for mining exploration in many remote places, but these deteriorate readily where not maintained.

A total of 36,114 km of standard-gauge railroads included two main systems—the Canadian National and the Canadian Pacific. The country also had about 3,000 km of inland waterways, which included the Saint Lawrence Seaway (one of the busiest in the world), which leads into the Great Lakes and marks the boundary with the United States in many places. Principal ports were Halifax, Montreal, Quebec, St. John (New Brunswick), St. John's (Newfoundland), and Toronto in the east and Vancouver on the west coast. Canada's merchant marine comprised about 114 ships of 1,000 or more gross registered tons.

The country had 1,417 airports. Among these, 517 had permanent-surface runways—18 had runways longer than 3,047 meters (m); 15 had runways from 2,438 to 3,047 m long; 151 had runways from 1,524 to 2,437 m in length; 244 had runways from 914 to 1,523 m in length; and 89 had runways under 914 m in length. Civil aviation included about 636 major transport aircraft; Air Canada was the major carrier (U.S. Central Intelligence Agency, 2003§).

Canada generated electrical power from coal, natural gas, and nuclear fuels, as well as massive hydroelectric facilities. Total capacity was roughly 114 gigawatts. About 576.2 net terawatthours, which was significantly less than capacity, was produced in 2000 (the last year for which data were available). Hydroelectric plants generated 61% of Canada's electricity; coal and fossil fuel, 25%; nuclear reactors, about 12%; and others, 2%. Quebec and Ontario produced the most electricity—154 and 141 megawatthours, respectively. Nearly 97% of Quebec's electricity came from hydroelectric plants, and the remaining 3% was produced mainly by nuclear facilities. In contrast, about 61% of Ontario's electric power was derived from nuclear plants, and the remainder, from hydroelectric and coal-fired plants. Most of Canada's electricity exports originated in New Brunswick, Ontario, and Quebec and were sold to consumers in New England and New York. British Columbia and Manitoba also exported large amounts of electricity, mainly to California, Minnesota, Oregon, and Washington. Except for Alberta, all Canadian Provinces that border the United States had transmission links to the neighboring systems. Canada was a net exporter of crude petroleum, natural gas, coal, uranium, and hydropower, and the country is the main source of U.S. energy imports (U.S. Central Intelligence Agency, 2003§; U.S. Energy Information Administration, 2004§).

An extensive system of pipelines connected petroleum- and gas-producing and consuming areas in Canada and the United States. The system was dominated by the Interprovincial Pipe Line, which delivered oil from Edmonton east to Montreal, Quebec, and the U.S. Great Lakes region, and the TransMountain Pipe Line, which delivered oil mainly from Alberta west to refineries and terminals in the Vancouver area and to the Puget Sound area of Washington. Canadian natural gas was transported largely by TransCanada Pipe Lines Ltd. of Calgary, which owned 13,600 km of mainline gas pipelines in Canada and 56 compressor stations that linked western Canadian gas producers with consumers in eastern Canada and the United States. Canada's pipeline network included about 24,000 km for crude petroleum and refined products and 75,000 km for transmission of natural gas. Alberta's network represents the greatest length for any Province (U.S. Central Intelligence Agency, 2003§; U.S. Energy Information Administration, 2004§).

Outlook

Canada's continued economic recovery will boost the country's economy in 2004 and beyond. Canada was a net exporter of minerals—metals, industrial minerals, and fuel minerals, uranium, and hydropower. Canada's mineral industry has been encouraged by the Federal Government to work with the mining sector to improve the permitting process. The goal is to allow exploration and mining companies to comply with the regulatory requirements in a timely and efficient way and at the same time to operate within high environmental and social standards. Exploration is key to assuring a long-term supply of Canadian minerals. Government and industry are enthusiastic about the concept of a Northern Mines Ministers Conference to be held each year to report on progress, to identify challenges, and to network with all affected stakeholders to re-establish an attractive investment climate and to reverse any economic difficulties, such as the costs of socioeconomic and impact benefit agreements with local aboriginal groups be deductible from royalties and eligible as exploration spending (Andrews, 2004).

Canada's dollar weakened against the U.S. dollar; presumably this helped exports but discouraged imports of certain necessary commodities, specialized equipment, and ad hoc professional expertise. The Hibernia offshore oil project began production with the promise of rich payoffs to come. After Hibernia, the Terra Nova and the White Rose fields in the Jeanne d'Arc Basin and others will be tested. Comparisons continue to be heard between the Canadian offshore field oil resources and the development of the now-legendary North Sea fields.

The nickel-copper-cobalt discovery at Voisey's Bay and the diamond discoveries at Diavik, Jericho, and Snap Lake make an impressive case for more exploration in Canada, no matter how attractive and lucrative the opportunities could be in Asia, Australia, and/or Latin America. In fact, Canada's successful Diavik and Ekati diamond mines encouraged significant new diamond discoveries in, in order of value, the Nunavut Territory, Alberta, Saskatchewan, Ontario, and Quebec.

The concerted effort to reconcile conflicting interests in the formulation of policy concerning ownership, aboriginal issues, mining development, environmental constraints and remediation, social instabilities, and economic necessity in furthering the concept of sustainable development has been difficult to assess or predict. Active engagement of these issues among the private sector, Government, and communities (stockholders and stakeholders) will probably help provide outcomes that would support the future of the Canadian mining industry.

Canada continues to be well-positioned in terms of its mineral-resource base and its access to the markets of, for example, Europe, Japan, and the countries of the North America Free Trade Agreement. Canada's mineral industry is primarily export oriented with as much as 92% of the production of some commodities going to world markets. The United States should continue to be a major market for Canada's minerals. In this regard, the industry's export capability is enhanced significantly by a lower exchange rate for the Canadian dollar.

Canada cannot escape the realities of globalization and internationalization, especially from developing countries that have competitive mineral resources and liberalized economic and political systems to attract foreign investment. Canada's greatest long-term asset may be the achievement of a popular consensus in support of sustainable development that respects the interests of mining companies, First Nation peoples, and the preservation of the environment.

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TABLE 1
CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1999	2000	2001	2002	2003[p]
METALS						
Aluminum:						
Alumina, gross weight[e]	thousand tons	1,233 [2]	1,200	1,200	1,200	1,200
Metal:						
Primary		2,389,835	2,373,460	2,582,746	2,708,910	2,791,915
Secondary		112,000	148,000	180,000	180,000 [r]	180,000
Total		2,501,835	2,521,460	2,762,746	2,888,910 [r]	2,971,915
Antimony[3]		357	433	234	143	88
Bismuth:						
Mine output, Bi content[3]		311	243	258	189	145
Metal, refined[e]		250 [r]	250 [r]	250 [r]	250 [r]	250
Cadmium:						
Mine output, Cd content[3]		1,390	1,051	979	896	710
Metal, refined		1,911	1,941	1,429	1,400 [e]	1,400
Calcium	kilograms	224,864	170,246	133,200	135,000 [e]	135,000
Cobalt:						
Mine output, Co content[3]		5,324	5,298	5,334	5,148 [r]	4,304
Metal:						
Shipments[4]		2,015	2,022	2,112	2,065 [r]	1,743
Refined, including oxide		3,972	4,079	4,063	4,100	4,100
Columbium and tantalum:						
Pyrochlore concentrate:						
Gross weight		5,140	5,070	7,070	7,410 [r]	7,270
Nb content		2,313	2,280	3,180	3,333 [r]	3,270
Tantalite concentrate:						
Gross weight		208	228	308	232	220
Ta content		54 [r]	57	77	58	55
Nb content		10 [r]	11	15	12	11
Copper:						
Mine output, Cu content[3]		581,583	633,855	683,531 [r]	584,195 [r]	534,287
Metal:						
Smelter:						
Primary, blister		542,439	545,514	552,512	538,790	543,282
Secondary and scrap		66,782	66,800	74,128	74,000 [e]	74,000
Total		609,221	612,314	626,640	612,790	617,282
Refined:						
Primary		476,079	551,393	567,720	494,522 [r]	454,866
Secondary		72,484	61,300	42,800	24,800 [r]	26,800
Total		548,563	612,693	610,520	519,322 [r]	481,666
Gold, mine output	kilograms	157,617	156,207	158,875	151,904 [r]	140,559
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	33,900	35,247	26,981	30,902 [r]	32,957
Fe content	do.	21,650	22,744	17,186	19,684 [r]	20,993
Metal:						
Pig iron	do.	8,783	8,900	8,780	8,800	8,800
Direct-reduced iron[e]	do.	920 [2]	920	920	920	920
Ferroalloys, electric arc furnace:[e]						
Ferrosilicon	do.	56	56	56	56	56
Silicon metal	do.	30	30	30	30	30
Ferrovanadium	do.	1	1	1	1	1
Total	do.	87	87	87	87	87
Crude steel	do.	16,300	15,900	16,300	16,300 [e]	16,300
Lead:						
Mine output, Pb content		162,180	148,769	153,932	101,330 [r]	81,268
Metal, refined:						
Primary		137,172	159,152 [r]	127,007	133,815	112,475
Secondary		129,243	125,141 [r]	103,921	117,449	110,742
Total		266,415	284,293 [r]	230,928	251,264	223,217

See footnotes at end of table.

TABLE 1--Continued
CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1999	2000	2001	2002	2003[p]
METALS--Continued						
Lithium, spodumene[e]		22,500	22,500	22,500	22,500	22,500
Magnesium, metal, primary[e]		80,000	80,000	83,000	88,000	54,000
Molybdenum, mine out, Mo content		6,250	7,457	8,556	7,953 r	9,671
Nickel:						
Mine output, Ni content[3]		176,749	190,793	184,300	189,297 r	162,756
Refined[5]		124,260	134,225	140,591	144,476	124,418
Platinum-group metals, mine output	kilograms	13,872	16,110	20,694	24,372 r	18,514
Selenium, refined[6]	do.	359,000	335,000	238,000	175,000 r	253,000
Silver:						
Mine output, Ag content		1,174,000	1,212,000	1,265,000	1,407,558 r	1,309,274
Refined		1,246,000	1,188,000	1,224,400	1,352,002 r	1,275,797
Tellurium, refined[6]		64,000	53,000	51,000	39,000 r	40,000
Titanium, slags[e, 7]		950,000	950,000	1,100,000 r	1,100,000 r	1,104,000
Uranium oxide, U content		10,157	10,683	12,991	12,855 r	9,906
Zinc:						
Mine output, Zn content		963,321	1,002,242	1,012,048	923,931 r	788,328
Metal, refined, primary		776,927	779,892	661,172	793,475	761,199
INDUSTRIAL MINERALS						
Asbestos		337,000	307,000	277,000	242,241 r	240,500
Barite		123,000	121,000	23,000	17,000 r	23,000
Cement, hydraulic[8]	thousand tons	12,625	12,612	12,986	13,710 r	14,063
Clay and clay products[9]	value, thousands	$164,718	$175,449	$194,580	$233,244 r	$234,775
Diamond	carats	2,429,000	2,533,750	3,716,000	4,937,000 r	11,200,000
Diatomite[e]		10,000	10,000	10,000	10,000	10,000
Gemstones, amethyst and jade		218	235	148	246 r	114
Gypsum and anhydrite	thousand tons	9,345	9,232	7,821	8,809 r	8,330
Lime[8]	do.	2,565	2,525	2,213	2,248 r	2,216
Magnesite, dolomite, brucite[e]		180,000	180,000	180,000	180,000	180,000
Mica, scrap and flake[e]		17,500	17,500	17,500	17,500	17,500
Nepheline syenite		676,000	717,000	710,000	717,000 r	697,000
Nitrogen, N content of ammonia		4,134,900	4,129,000	3,438,700	3,440,000	3,440,000
Potash, K_2O equivalent	thousand tons	8,475	9,202	8,237	8,361 r	9,131
Pyrite and pyrrhotite, gross weight[e]		5,000	5,000	5,000	5,000	5,000
Salt	thousand tons	12,686	11,994	13,725	12,736 r	13,390
Sand and gravel	do.	242,369	238,494	236,486	238,120 r	235,574
Silica, quartz[10]	do.	1,702	1,514	1,613	1,540 r	1,586
Sodium compounds, n.e.s.:[e]						
Sodium carbonate, soda ash	do.	300	300	300	300	300
Sodium sulfate, natural[11]	do.	305 [2]	305	305	305	305
Stone[12]	do.	130,226	139,188	124,758	124,746 r	119,356
Sulfur, byproduct:						
Metallurgy	do.	843	849	762	703 r	589
Petroleum	do.	8,656	8,621	8,154	7,671 r	7,920
Total	do.	9,499	9,470	8,916	8,374 r	8,509
Talc, pyrophyllite, soapstone[e]	do.	79 [2]	90	90	90	90
MINERAL FUELS AND RELATED PRODUCTS						
Carbon black[e]		165,000	165,000	165,000	165,000	165,000
Coal, run-of-mine:						
Bituminous and subbituminous	thousand tons	60,834	58,037	59,042	55,408 r	50,929
Lignite	do.	11,663	11,126	11,319	11,200	11,234
Total	do.	72,497	69,163	70,361	66,608 r	62,163
Coke, high-temperature	do.	3,307	3,307	3,300	3,300 e	3,300
Natural gas:						
Gross	million cubic meters	190,912	195,457	200,709	200,890	193,253
Marketed	do.	162,219	166,078	171,388	171,348	164,834
Natural gas liquids:						
Pentanes plus	thousand 42-gallon barrels	67,735	67,700	66,000	66,000 e	66,000
Condensate	do.	2,930	2,900	2,800	2,800 e	2,800
Total	do.	70,665	70,600	68,800	68,800 e	68,800

See footnotes at end of table.

TABLE 1--Continued
CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1999	2000	2001	2002	2003[p]
MINERAL FUELS AND RELATED PRODUCTS--Continued						
Peat		1,253	1,277	1,319	1,385 [r]	1,341
Petroleum:						
Crude[13]	thousand 42-gallon barrels	768,934	803,919	816,505	861,730 [r]	907,018
Refinery products:[e]						
Propane, butane, naphtha, liquefied petroleum gas	do.	12,700	13,300	13,700	14,800 [r]	14,900
Gasoline:						
Aviation	do.	790	900	850	1,050 [r]	1,000
Other	do.	218,000	228,000	235,000	255,000 [r]	260,000
Petrochemical feedstocks	do.	28,500	29,800	30,800	33,700 [r]	34,100
Jet fuel	do.	29,700	31,100	32,100	35,300 [r]	35,700
Kerosene	do.	1,700	1,700	1,800	2,100 [r]	2,100
Distillate fuel oil, diesel and light	do.	167,000	175,000	180,000	194,000 [r]	19,500
Lubricants including grease	do.	6,700	7,000	7,200	7,500 [r]	7,600
Residual fuel oil, heavy	do.	43,100	45,100	46,500	50,600 [r]	51,200
Asphalt	do.	22,100	23,200	23,900	26,300 [r]	26,100
Petroleum coke	do.	6,200	6,500	6,700	7,400 [r]	7,500
Unspecified	do.	22,500	23,600	24,300	26,800 [r]	27,200
Refinery fuel and losses[14]	do.	21,800	22,800	23,500	25,300 [r]	25,600
Total	do.	581,000	608,000	626,000	680,000 [r]	513,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through July 2004.

[2]Reported figure.

[3]Metal content of concentrates produced.

[4]Cobalt content of all products derived from Canadian ores, which includes cobalt oxide shipped to the United Kingdom for futher processing and nickel-cobalt matte shipped to Norway for refining.

[5]Nickel contained in products of smelters and refineries in forms, which are ready for use by consumers. Natural Resources Canada has revised all refined nickel figures to conform with International Nickel Study Group (INSG) guidelines.

[6]From all sources, which includes imports and secondary sources. Excludes intermediate products exported for refining.

[7]Refined UGS and SOREL slags have titanium oxide content of 94.5% (chloride process) and 80% (sulfide process), respectively.

[8]Producers' shipments and quantities used by producers.

[9]Includes bentonite products from common clay, fire clay, stoneware clay, and other clays. Values are in current Canadian dollars.

[10]Producers' shipment of quartz.

[11]Excludes byproduct production from chemical plants.

[12]Crushed, building, ornamental, paving, and similar stone.

[13]Includes synthetic crude, from oil shale and/or tar sands.

[14]Refinery fuel represents total production of still gas, which includes a small amount sold.

TABLE 2
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Alcan Aluminum Ltd.	Smelter in Laterriere, Quebec	204.
Do.	do.	Smelter in Isle-Maligne, Quebec	73.
Do.	do.	Smelter in Beauharnois, Quebec	48.
Do.	do.	Smelter in Shawinigan, Quebec	84.
Do.	do.	Smelter in Grande-Baie, Quebec	180.
Do.	do.	Smelter in Arvida, Quebec	232.
Do.	do.	Smelter in Kitimat, British Columbia	272.
Do.	Alcan Inc. (Alcan Aluminium Ltd., 56%, and Aluisuisse Lonza Group Ltd., 44%)	Smelter in Alma, Quebec	400.
Do.	Aluminiere de Becancour Inc. (Pechiney Corp., 25%, and Quebec Government, 24.95%)	Smelter in Beacancour, Quebec	360.
Do.	Canadian Reynolds Metals Co. Ltd. (Reynolds Metals Co., 100%)	Smelter in Baie-Comeau, Quebec	400.
Do.	Aluminerie Alouette Inc. (Vereinigte Aluminum-Werke (VAW), Germany, 20%; Corus Group plc, Netherlands, 20%; Austria Metall (AMAG), Austria, 20%; La Société Générale de Financement, Canada, 20%; Kobe Steel, 13.3%; Marubeni Corp., Japan, 6.7%)	Smelter in Sept-Iles, Quebec	218.
Do.	Aluminerie Lauralco Inc. (Alumax Inc., United States)	Deschambault, Quebec	215.
Asbestos	LAB Chrysotile, Inc. (private, 100%).	Black Lake, Quebec	160 (fiber).
Do.	do.	Bell Mine, near Thetford Mines, Quebec	70 (fiber).
Do.	Jeffrey Mine Inc.	Jeffrey mines at Asbestos, Quebec	250 (fiber).
Cement	Lafarge Canada Inc.	Bath, Ontario	1,045 (dry-process).
Do.	do.	Exshaw, Alberta	1,029 (dry-process).
Do.	do.	Kamloops, British Columbia	194 (dry-process).
Do.	do.	Richmond, British Columbia	474 (wet-process).
Do.	do.	St. Constant, Quebec	991 (dry-process).
Do.	do.	Brookfield, Nova Scotia	527 (dry-process).
Do.	St. Lawrence Cement Inc. (Independent Cement Inc.)	Joliette, Quebec	991 (dry-process).
Do.	do.	Mississauga, Ontario	1,876 (wet and dry).
Do.	ESSROC Canada Inc.	St. Basile, Quebec	1,124 (dry-process).
Do.	North Star Cement Ltd.	Corner Brook, Newfoundland	152 (dry-process).
Do.	Federal White Cement Ltd.	Woodstock, Ontario	170 (dry-process).
Do.	St. Marys Cement Corp.	Bowmanville, Ontario	1,550 (dry-process).
Do.	do.	St. Marys, Ontario	645 (dry-process).
Do.	Inland Cement Ltd. (S.A. Cimenteries CBR)	Edmonton, Alberta	726 (dry-process).
Do.	Tilbury Cement Ltd. (S.A. Cimenteries CBR)	Delta, British Columbia	1,040 (dry-process).
Coal	Quinsam Coal Corp. (Hillsborough Resources Ltd., 63%; Marubeni Corp., 33%; unknown, 4%)	Quinsam Coal Mine at Campbell River, British Columbia	14,400 (open pit and underground).
Do.	Cape Breton Development Corp. (Government of Canada, 100%)	Sydney, Nova Scotia	2,000 (underground).
Do.	Luscar, Ltd. (Luscar Energy Partnership)	Obed Mountain Mine in Hinton, Alberta	23,500 (open pit).
Do.	do.	Cheviot Mine in Hinton, Alberta	16,500 (open pit).
Do.	Gregg River Resources Ltd. (Gregg River Coal Inc., 60%, and 7 Japanese companies, 40%)	Gregg River Mine in Hinton, Alberta	3,960 (open pit).
Do.	Manalta Coal Ltd. (Transalta Utilities Corp.)	Highvale Mine at Seba Beach, Alberta	11,610 (open pit).
Do.	Smoky River Coal Ltd. (Smoky River Holdings Ltd., 100%)	Grande Cache, Alberta	3,600 (open pit and underground).
Columbium (niobium)	Niobec Ltd. (Cambior Inc., 50%, and Sequoia Minerals Inc., 50%)	Niobec Mine, Chicoutimi, Quebec	3,500 tons per day (underground).

See footnotes at end of the table.

TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper		Cassiar Mining Corp. (Princeton Mining Corp., 100%)	Similcom Mine in Princeton, British Columbia (suspended in 1996)	9,000.
Do.		Falconbridge Ltd. (Noranda Inc., 50%, and Trelleborg AB, 50%)	Sudbury operations, Sudbury, Ontario	4,250.
Do.		do.	Strathcona and Timmins operations in Timmins, Ontario	4,860.
Do.		Falconbridge Ltd. (Noranda Inc., 50%, and Trelleborg AB, 50%)	Smelter in Timmins, Ontario	440.
Do.		Gibraltar Mines Ltd.	McLease Lake, British Columbia (suspended)	29.
Do.		Highland Valley Copper (Teck Cominco Limited, 63.9%; BHP Billiton Ltd., 33.6%; others, 2.5%)	Kamloops, British Columbia	4,500.
Do.		Inco Ltd.	Thompson district, Manitoba	Variable (polymetallic).
Do.		do.	Smelter in Sudbury, Ontario	500.
Do.		do.	Refinery in Sudbury, Ontario	170.
Do.		Noranda Inc.	Smelter in Thompson, Manitoba	686 (projected).
Do.		do.	Mines Gaspe, Murdochville, Quebec	4,000 (ore).
Do.		do.	Horne Smelter in Noranda, Quebec	770.
Do.		Huckleberry Mines Ltd. (Imperial Metals Corp., 50%, and Japanese consortium, 50%)	Huckleberry Mine in Omineca, southeast of Houston, British Columbia	37 (Cu contained).
Do.		Imperial Metals Corp.	Mount Polley Mine at Williams Lake, British Columbia	17 (Cu contained).
Do.		Northgate Exploration Ltd.	Toodogone River, British Columbia	28 (Cu contained).
Diamond	carats	BHP Billiton Diamonds Inc. (BHP Billiton Group), 80%; Charles Fipke, 10%; Stuart Blossom, 10%	Ekati Mine in Lac de Gras region, Northwest Territories	5,350,000.
Do.	do.	Diavik Diamond Mines Inc. (Rio Tinto plc), 60%, and Aber Diamond Mines Ltd. (Aber Diamond Corporation), 40%	Diavik Mine in Yellowknife region, Northwest Territories	6,000,000.
Gold		Barrick Gold Corp.	Holt-McDermott Mine at Harker Township, Ontario	405 (ore).
Do.		do.	Bosquet Mines 1 and 2, northwestern Quebec	954 (ore).
Do.		do.	Macassa Mine at Teck Township, northern Ontario	473 (ore).
Do.		Princeton Mining Corp.	Similco Mine in Princeton, British Columbia (suspended)	450 (kilograms metal).
Do.		Echo Bay Mines Ltd.	Lupin Mine in Contwoyo Lake, Northwest Territories (suspended)	612 (ore).
Do.		Royal Oak Mines Inc.	Giant Mine in Yellowknife, Northwest Territories	407 (ore).
Do.		do.	Giant mill-tailings in Yellowknife, Northwest Territories	3,265 (ore).
Do.		Hemlo Gold Mines Inc. (Noranda Inc., 44.1%)	Golden Giant Mine in Hemlo, Ontario	1,080 (ore).
Do.		Placer Dome Inc.	Campbell Mine in Red Lake, Ontario	584 (ore).
Do.		do.	Detour Lake Mine in Northeast Ontario	1,278 (ore)
Do.		do.	Dome Mine in South Porcupine, Ontario	9.8 (tons metal).
Do.		do.	Sigma and Kiena Mines in Val d'Or, Quebec	730 (ore).
Do.		Teck-Corona Corp. (Teck Corp., 100%)	David Bell Mine in Hemlo, Ontario	456 (ore).
Do.		Huckleberry Mines Ltd. (Imperial Metals Corp., 50%, and Japanese consortium, 50%)	Huckleberry Mine in Omineca, southeast of Houston, British Columbia	250 (kilograms metal).
Do.		Imperial Metals Corp.	Mount Polley Mine in Williams Lake, British Columbia	3,100 (kilograms metal).
Do.		Northgate Exploration Ltd.	Toodogone River, British Columbia	8,700 (kilograms metal).
Graphite		Strategic Exploration Inc.	Kearney Lake, Ontario	W.

See footnotes at end of the table.

TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gypsum	Atlantic Gypsum Resources Inc.	Fischell Brook at St. George's, Newfoundland	1,300.
Do.	Georgia-Pacific Corp.	River Denys, Sugar Camp, Nova Scotia	1,460.
Do.	Little Narrows Gypsum Co. Ltd. (USG Corp., 100%)	Little Narrows, Nova Scotia	1,640.
Do.	National Gypsum (Canada) Ltd. (Aancor Holdings Corp., 100%)	Milford, Nova Scotia	3,300.
Do.	Westroc Industries Ltd.	Windermere, British Columbia	1,170.
Iron and steel	Iron Ore Company of Canada (North Ltd., 56.1%; Mitsubishi Corp., 25%; Labrador Iron Ore Royalty Income Fund, 18.9%)	Carol Lake, Labrador	8,800 (concentrate), 10,300 (pellets).
Do.	Quebec Cartier Mining Co. (Dofasco Inc., 50%)	Mount Wright, Quebec	16,950 (concentrate), 7,500 (acid pellets), 657 (sinter).
Do.	Wabush Mines Ltd. (Stelco Inc., 37.9%; Dofasco Inc., 24.2%; Cliffs Mining Co., 22.8%; Acme Steel Co., 15.1%)	Wabush, Labrador, and Pointe Noire, Quebec	6,200 (concentrate).
Do.	Dofasco Inc.	Hamilton, Ontario	3,642 (pig iron), 4,500 (crude steel).
Lead	Brunswick Mining and Smelting Corp. Ltd. (Noranda Inc., 63.3%)	No. 12 Mine in Bathurst and smelter in Belledune, New Brunswick	72 (Pb contained).
Do.	Hudson Bay Mining and Smelting Co., Ltd. (Anglo American plc., 100%)	Flin Flon and Snow Lake, Manitoba	60 (Pb-Zn contained).
Do.	Teck Cominco Limited	Trail, British Columbia	95 (refined lead).
Do.	do.	Sullivan Mine in Kimberly, British Columbia	3,600 (ore).
Do.	do.	Polaris Mine on Cornwallis Island, Northwest Territories	1,000 (ore).
Do.	Breakwater Resources Ltd.	Nanisivik Mine on Baffin Island, Northwest Territories	785 (ore).
Limestone	Lafarge Canada Inc.	Steep Rock, Manitoba	906 (quarry).
Do.	Atlantic Industrial Minerals Inc.	Iris Cove, Sydney, Nova Scotia	720.
Do.	Inland Cement Ltd. (CBR Materials Corp.)	Cadomin, Alberta	2,160.
Do.	do.	do.	2,160 (quarry).
Do.	Havelock Co. (Kickenson Mines Co., 100%)	Havelock, New Brunswick	864 (limestone).
Do.	Continental Lime Ltd.	Faulkner, Manitoba	1,440 (crushed stone).
Magnesium	Magnola Metallurgy Inc. (Noranda Inc., 80%, and Societe Generale de Financement du Quebec, 20%)	Asbestos, Quebec	58 (asbestos waste).
Do.	Timminco Ltd.	Haley Station, Ottawa	6 (smelter).
Do.	Norsk Hydro Canada Inc.	Bécancour, Quebec	48 (smelter).
Molybdenum	Huckleberry Mines Ltd. (Princeton Mines Corp., 60%, and Japanese consortium, 40%)	Southeast of Houston, British Columbia	635 (Mo contained).
Nickel	Falconbridge Ltd. (Noranda Inc., 46.4%, and underwriting syndicate, 28.3%)	Craig, Fraser, Lindsley, and Lockerby in Sudbury district, Ontario	54 (metal contained).
Do.	do.	Raglan Mine in Ungave, Quebec	21 (metal contained).
Do.	do.	Smelter in Falconbridge, Ontario	45 (rated capacity).
Do.	Inco Limited	Frood, Stobie, Creighton, Copper Cliff North and South, Garson-Offsets, McCreedy East and West, Coleman, Crean Hill, and Totten in Sudbury district, Ontario	106 (metal contained).
Do.	do.	Smelter in Sudbury, Ontario	110 (metal contained).
Do.	do.	Refinery in Sudbury, Ontario	57 (metal contained).
Do.	do.	Refinery in Port Colborne, Ontario	30 (metal contained).
Do.	do.	Thompson, Birchtree Mines in Manitoba	62 (metal contained).
Do.	do.	Smelter in Thompson, Manitoba	82 (metal contained).
Do.	Sherritt International Corp.	Refinery in Fort Saskachewan, Alberta	24 (metal contained).

See footnotes at end of the table.

TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum and natural gas:[1]			
Natural gas--million cubic meters	BP Canada Inc. (The British Petroleum Co. plc, London, 100%)	Noel Area, northern Alberta; Chauvin, Sibbald, North Pembina, Alberta	47.
Crude oil million 42-gallon barrels	do.	do.	12.
Do. do.	Gulf Canada Corp. (Olympia & York Developments, 80%, and Gulf, 20%)	Fenn-Big Valley, Swan Hills, Goose River, Peerless, and Sene, Alberta	18.
Do. do.	Home Oil Co. Ltd. (Interhome Energy Inc., 100%)	Red Earth, Garrington, Cherhill, Medicine River, and Swan Hills, Alberta	11.5.
Natural gas billion cubic meters	do.	do.	1.8.
Crude oil thousand 42-gallon barrels	Imperial Oil Ltd. (Exxon Mobil Corp., 70%, and others, 30%)	Judy Creek, Cold Lake, Alberta; Mackenzie Delta, Beaufort Sea, Yukon and Northwest Territories	670.
Natural gas--million cubic meters	do.	do.	36.4.
Crude oil million 42-gallon barrels	Mobil Oil Canada Ltd. (Exxon Mobil Corp., 100%)	Hibernia, Grand Banks, southeast of Newfoundland and Sable Island, Nova Scotia, and others in Alberta	26.1.
Natural gas billion cubic meters	do.	do.	3.0.
Crude oil million 42-gallon barrels	Mobil Oil Canada Ltd. (Exxon Mobil Corp., 100%)	Terra Nova, near to Hibernia, Jeanne d'Arc Basin, Newfoundland	25.0.
Natural gas billion cubic meters	do.	do.	2.0.
Crude oil million 42-gallon barrels	Norcen Energy Resources Ltd. (Hollinger Inc., 59%, and Hees International, 41%)	Pembina, Bodo, Majorville, Alberta	12.1.
Do. do.	Oakwood Petroleums Ltd. (Sceptre Resources Ltd., 100%)	Grantham, Hays Ronalane, Peace River, Normandville, Randell, Alberta; and Grizzly Valley, British Columbia	24.6.
Do. do.	PanCanadian Petroleum Ltd. (Canadian Pacific Enterprises, 87%, and others, 13%)	Rycroft, Wembley, Elk Point, Rio Bravo, Alberta	19.7.
Natural gas billion cubic meters	do.	do.	3.53.
Crude oil million 42-gallon barrels	Shell Canada Ltd. (Shell Investments, 79%, and others, 21%)	Dimsdale, Little Smoky Lake, Sousa, Alberta; Midale, Benson, Saskatchewan	22.2.
Natural gas billion cubic meters	do.	do.	6.53.
Crude oil million 42-gallon barrels	Suncor Inc. (Sun Co. Inc., United States, 75%, and Ontario Energy Resources, 25%)	Kidney, Zama Lake, Cosway, Albersun Prevo, and Medicine River, Alberta; and Leitchville, Unwin, Saskatchewan	4.1.
Do. thousand 42-gallon barrels	Texaco Canada Petroleum Inc. (Texaco Inc., United States, 78%, and others, 22%)	Eaglesham, Virgo, Alberta; and Desan, British Columbia	158.
Natural gas--million cubic meters	do.	do.	67.3.
Crude oil million 42-gallon barrels	UNOCAL Canada Ltd. (UNOCAL Corp., United States, 100%)	Calgary, Alberta	14.7.
Potash (K_2O equivalent):	Potash Corp. of Saskatchewan Inc. (PCS) (private, 37%, and Provincial government, 63%)	Lanigan, near Lanigan, Saskatchewan	3,828 (KCl).
Do.	do.	Rocanville, southeast Saskatchewan	2,295 (KCl).
Do.	do.	Allan Division, Allan, Saskatchewan	5,256 (KCl).
Do.	do.	Cory, near Saskatoon, Saskatchewan	1,361 (KCl).
Do.	do.	Sussex, New Brunswick	800 (KCl).
Do.	International Minerals & Chemical Corp. (Canada) Ltd. [IMC Fertilizer Corp., 75%, and Potash Corp. of Saskatchewan Inc. (PCS), 25%]	Esterhazy, southeast Saskatchewan	951 (KCl).
Do.	Agrium Products Inc.	Vanscoy, Saskatchewan	1,750 (KCl).
Salt and brine operations	The Canadian Salt Co.	Pugwash, Nova Scotia	1,400 (rock salt and brine salt).
Do.	do.	Iles-de-la-Madeleine, Quebec	1,625 (rock salt).
Do.	do.	Ojibway, Ontario	2,600 (rock salt).

See footnotes at end of the table.

TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Silver	Prime Resources Group Inc.	Eskay Creek Mine in British Columbia	340.
Do.	Breakwater Resources Ltd.	Caribou Mine in Bathurst, New Brunswick	7.5 (tons mill feed).
Do.	Kinross Gold Corp.	Macassa Mine in Ontario	438 (mill feed).
Do.	Barrick Gold Corp.	Bousquet Mine in Quebec	876 (mill feed).
Do.	Similco Mines Ltd.	Princeton, British Columbia (suspended)	8,250 (Ag-Au-Cu concentrate).
Sodium chlorate production using salt	Dow Chemical Canada Inc. (Dow Chemical Co., 100%)	Fort Saskatchewan, Alberta	524 (caustic soda).
Do.	do.	Sarnia, Ontario	350 (caustic soda).
Do.	General Chemical Canada Ltd.	Amherstburg, Ontario	363 (sodium carbonate).
Sulfur:			
Petroleum refinery capacities	Consumer's Cooperative Refineries Ltd. (Federated Cooperatives Ltd., 100%)	Regina, Saskatchewan	54.
Do.	Esso Petroleum Canada (ExxonMobil Corp., 100%)	Sarnia, Ontario	50.
Do.	Sulconam Inc. (Petro Canada, 7.6%)	Montreal, Quebec	108.
Main sulfur extraction plants (sour gas and oil sands)	Amoco Canada Petroleum Co., Ltd. (Amoco Corp., 100%)	East Crossfield-Elkton, Alberta	650.
Do.	Canadian Occidental Petroleum, Ltd.	East Calgany-Crossfield, Alberta	610.
Do.	Chevron Canada Resources Inc. (ChevronTexaco Corp., 100%)	Kaybob South III, Alberta	1,281.
Do.	Husky Oil Ltd.	Ram River, Ricinus, Alberta	1,646.
Do.	Shell Canada Ltd.	Waterton, Alberta	1,120.
Principal SO_2 and H_2SO_4 production capacities	Canadian Electro Zinc Ltd. (CEZ) (Noranda Inc., 90.17%)	Valleyfield, Quebec	430 (H_2SO_4).
Do.	Inco Ltd.	Copper Cliff, Ontario	950 (H_2SO_4).
Do.	Falconbridge Ltd. (Noranda Inc., 50%, and Trelleborg AB, 50%)	Kidd Creek, Ontario	690 (H_2SO_4).
Do.	ESSO Chemical Canada (ExxonMobil Corp., 100%)	Redwater, Alberta	910 (H_2SO_4).
Titanium slag	QIT-Fer et Titane Inc. (Rio Tinto, 100%).	Sorel-Tracy, Quebec	1,100 (Sorelslag), 250 (UGS slag).
Uranium	Cogema Resources Inc.	Cluff Lake, Saskatchewan	1,815 metric tons (metal).
Do.	Cameco Corp. (Cameco Corp., 50.025%; COGEMA Resources Inc., 37.1%; Idemitsu Inc., 7.875%; TEPCO Inc., 5.0%).	Cigar Lake, Saskatchewan	6,500 metric tons (oxide).
Do.	do.	Key Lake, Saskatchewan	6,395 metric tons (oxide).
Do.	do.	Rabbit Lake, Saskachewan	5,445 metric tons (oxide).
Zinc	Breakwater Resources Ltd.	Nanisivik Mine on Baffin Island, Northwest Territories	60 (Zn contained).
Do.	do.	Bathurst, New Brunswick	1,100 (Zn in concentrate).
Do.	Brunswick Mining and Smelting Corp. Ltd. (Noranda Inc., 100%)	do.	232 (Zn in concentrate).
Do.	Falconbridge Ltd. (Noranda Inc., 49.9%)	Timmins operations and smelter in Timmins, Ontario	212 (Pb-Zn contained), 133 (slab zinc).
Do.	Hudson Bay Mining and Smelting Co. Ltd. (Anglo American plc., 100%)	Snow Lake concentrator, Manitoba	1,125 (Pb-Zn ore).
Do.	do.	Flin Flon Mine and Smelter in Manitoba	115 (slab zinc).
Do.	Teck Cominco Limited	Sullivan Mine in Kimberley, British Columbia	70 (Pb-Zn contained).
Do.	do.	Smelter in Trail, British Columbia	300 (slab zinc).
Do.	Boliden Ltd.	Myra Falls Mine in Strathcona Provincial Park, British Columbia	110 (Zn ore).
Do.	Noranda Inc.	Bell Allard Mine in Matagami, Quebec	85 (Pb-Zn ore).

W Withheld to avoid disclosing company proprietary data.
[1]Projections of annual capacity involve matching decline curves against later discoveries and are generalized extrapolations only based on data presented in the Canadian Oil and Gas Handbook, 2001 and subsequent years. Ownership of various companies and proportionate participation in various leaseblocks and/or joint ventures changes continually. The ownership proportions shown here must be considered to be illustrative only.

TABLE 3
CANADA: RESERVES OF MAJOR MINERALS IN 2003

(Thousand metric tons unless otherwise specified)[1]

Commodity		Reserves
Asbestos, fiber		35,700 [e]
Coal, all types		6,220,000 [e]
Copper		10,000
Gold	metric tons	1,500 [2]
Gypsum		450,000 [e]
Iron ore		1,700,000 [e]
Lead		1,600
Molybdenum		450
Natural gas	billion cubic meters	1,660 [3]
Nickel		6,600
Petroleum crude	million barrels	16,900 [3]
Potash, K_2O equivalent	million metric tons	4,400 [e]
Salt	thousand short tons	264,000 [e]
Silver	metric tons	47,000
Sodium sulfate	thousand short tons	84,000 [e]
Sulfur		160,000 [e]
Uranium		420 [4]
Zinc		11,000

[e]Estimated; estimated data are rounded to three significant digits; may not add to totals shown.

[1]Sources: 2002 and 2003 "Canadian Minerals Yearbook," Natural Resources Canada, except for natural gas and petroleum crude; U.S. Geological Survey's Mineral Commodity Summaries 2004.

[2]Excludes metal in placer deposits.

[3]Source: BP 2004, Statistical Review of World Energy.

[4]Recoverable at prices of $100, or less per kilogram of uranium.